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LAND UTILIZATION

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LAND UTILIZATION

Avakian, A. H.

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California Forest and Range Experiment Station Library
Berkeley, California
April, 1937

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A M Avakian

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STUDIES OF SAND DUNES ALONG LAKE MICHIGAN

By Hugh P. Baker,
Forest Assistant, Bureau of Forestry

Natural Fixation of the Dunes

As the newly formed active dunes move inland far enough to be out of range of the stronger currents of wind coming directly from the lake, or as new dunes form upon the beach to the windward acting as a windbreak, favorable conditions are increased for a growth of natural vegetation on sand. Seeds of grasses and herbs are blown onto the dunes and those adapted for growth under such trying conditions take root and grow and gradually spread until the dune is entirely covered. Meanwhile, seeds of shrubs and trees have reached the dune and the covering of grasses and herbs making right conditions for their germination and growth, the dune gradually becomes forested. Only a few plants, such as certain species of grasses and shrubs, are capable of growing upward through accumulating sand. Most trees and shrubs native to the region die if stems or crowns are buried to any extent, hence the dunes must be covered with herbaceous growth, or fixed by some other means, before a forest growth can become successfully established.

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That a grass or herb may be perfectly adapted for growth on an active dune and capable of eventually making the dune permanent, it must be able to grow upward as the dune increases in height, must spread by means of rhizome propagation, and must be a perennial.

These conditions are fulfilled most successfully along the shore of Lake Michigan by the common sea-sand reed (Ammophila arenaria). Another grass of almost equal value is Agropyrum dasystachyum. Elymus canadensis and Calamagrostis langifolia are also valuable sand-binders, but are less hardy and vigorous on active dunes than the first two mentioned.

Certain shrubs meet the requirements for perfect sand-binders almost as well as some of the grasses. Among these the willows, Salix adenophylla, and S. glaucophylla, and the sand cherry (Prunus pumila), are of especial importance. The chief reason why these willows are so valuable is that roots are sent out from all the buried portions, even up as far as the flowers themselves. They can also be again uncovered and the newly formed roots destroyed without the plant suffering serious injury. Cornus stolonifera is also a valuable shrub for dune fixation, though it is much less able to adapt itself to the varied conditions of dune growth than the willows and the cherry.

The only native trees of any great value in fixing and then holding the dunes are two of the common poplars, Populus deltoides and its varieties, and P. balsamifera. Of

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these the first named is the more important, though neither have to any extent the vegetative propagation of the willows. The seeds of these trees germinate readily in protected depressions on the dunes, and the young plants grow very rapidly, forming dense groups which are exceedingly valuable in fixing the dunes.

After these species, which are especially adapted for growth in drifting sand, become established and prevent wholly or in part the movement of the sand, other less hardy species take advantage of the changed conditions, and a complex covering of vegetation is formed. Many annual and perennial herbs spring up, and among the best for holding the sand are: Corispernum hyssopifolium, Euphorbia polygonifolia, Cnicus pitcheri, Lathyrus maritimus, Artemisia canadensis, Juncus balticus littoralis. These are followed by such shrubs as Prunus, Vitis, Arctostaphylus, Gaylussacia, Celastrus, Rhus, Juniperus, Smilax, and Hamamelis. Trees usually come with or soon after the shrubs, and among the first are, of course, the poplars, then scarlet oak (Quercus coccinea), yellow oak (Q. velutina), and red oak (Q. rubra); jack pine (Pinus divaricata), white pine (P. strobus), and Norway pine (P. resinosa); basswood (Tilia americana), beech (Fagus atropunicea), hemlock (Tsuga canadensis), red cedar (Juniperus virginiana), white ash (Fraxinus americana), Hornbeam (Ostrya virginiana), hackberry (Celtis occidentalis), and sometimes species of maple (Acer), birch (Betula), and elm (Ulmus).

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The trees growing upon these dunes seem to make as rapid growth as upon the heavier soils in the interior. No data as to growth of trees in the dune sand were obtained.

After a dune is thoroughly held by a growth of forest trees, there is little danger of its transformation to an active dune, except through agencies already described. The large dune areas about the cities and towns could easily be made to yield much timber and fuel, both by conservative management of existing forests and by planting valuable species upon shrub or grass-covered areas or where worthless forest weeds now predominate.

Artificial Fixation of Dunes

By Planting of Grass

Only in a few places along the Michigan shore have attempts at artificial fixation of the shifting dunes been made, and, for reasons to be considered later, these attempts have not succeeded or have been only partially successful. A few of the coast cities, and especially those located about the harbors at the mouths of rivers, have been compelled to take some action or suffer great loss, either to the industries of the city as a whole, or by the destruction of private dwellings with adjacent gardens and fields. Work of reclamation has thus been in progress, often for years, at Michigan City, Indiana, and St. Joseph, Grand Haven, and Muskegon, Mich.

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Extensive experiments upon the dunes of France and Germany have shown that complete permanency of the sand can only be secured by a forest cover. Hence, the ultimate aim in all plans for artificial fixation of dunes should be the securing of a growth of forest trees wherever they can be made to grow. As along the sea coast dunes of France, so here with our Atlantic Coast and lake dunes there will be a narrow strip just back of the beach proper, varying in width from a few feet to several rods where trees will not grow because of exposure to salt spray and severe winds. The proper distance from the lake beach at which planting can be done has not yet been ascertained, and can only be found after considerable experiment. The probabilities are, if species can be used which will resist the effects of severe winds, that planting can be begun just above high-water mark, as fresh water spray is not injurious to most trees. If it is necessary to leave a narrow strip between the beach and the established dune, this must be held in place by a covering of grass or shrubs.

As explained under the discussion on the natural fixation of dunes, trees or shrubs can not usually be planted directly on the drifting sand, but must be preceded by the planting of grass, which holds the sand temporarily until trees can be started. Thus there are two distinct steps in the work of fixation: (1) Temporary holding of sand by planting of grass or by means of inert materials. (2) Planting of shrubs and trees with the ultimate idea of permanent forest growth.

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As the result of years of grass planting on Cape Cod, it has been found that fall planting generally brings the best results. No definite data upon this subject was obtained upon the Michigan coast, but as climatic conditions are not as severe as along the Atlantic Coast there will probably be found little or no difference in results between fall or spring planting.

In the planting of grass by the city of Grand Haven along its western border, seeds of three varieties of grass secured from France were used. One of these grasses was probably the common sand-reed grass, (Ammophila arenaria) and another a species of the genus Elymus. The grass did well at first and formed dense mats of vegetation in scattered areas over the dune, but constant care was not given and the results have been unsatisfactory.

The best results can be obtained, as a rule, by the use of healthy plants two or three years old, rather than the direct sowing of seed. Unless the sand is temporarily quiet through use of brush, or some similar inert material, the seed will generally be either covered too deep for germination by the drifting sand, or be carried away as the surface sand is moved by the winds.

In the work of transplanting only vigorous, well-rooted plants should be used. These should not be pulled from the sand, but lifted with a spade, and then care should be taken that the roots do not become too thoroughly dried out.

As the result of years of grass planting on Cape Cod, it has been found that fall planting generally brings the best results. No definite data upon this subject was obtained upon the Michigan coast, but as climatic conditions are not as severe as along the Atlantic Coast there will probably be found little or no difference in results between fall or spring planting.

In the planting of grass by the city of Grand Haven along its western border, seeds of three varieties of grass secured from France were used. One of these grasses was probably the common sand-reed grass, (Ammophila arenaria) and another a species of the genus Elymus. The grass did well at first and formed dense mats of vegetation in scattered areas over the dune, but constant care was not given and the results have been unsatisfactory.

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The larger bunches can be separated into several parts, as long as each part has a good supply of roots. In the actual planting of the grass, it is of advantage for two men to work together. One, using a spade, or straight-bladed shovel, can make an opening in the sand with a few movements of the shovel, and the second man, following with the grass, sets the plants and packs the sand firmly about the roots. It is estimated that two men can thus set out from 500 to 600 plants per hour.

It has been determined, from various experiments along the coast of Europe and at Cape Cod, that the best distance for setting the plants is approximately 20 inches apart. This is varied with the requirements of the situation. On very exposed slopes it might be advantageous to plant closer, or, on protected places, farther apart. The thinner planting allows greater area for development of the root system, and thus increases the vigor and growth of the plants. The greater cost of thick planting is only justified where necessity for such planting is great. In Europe the planted areas are usually protected for the first few years by low wattles or brush hedges, and they have proven of such value that plantings along our own coast or lake shores would be more successful if protected in similar ways. These brush hedges are left on the ground until the tree seedlings, wherever set out, have gotten a fair start.

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In writing of the reclamation of the Cape Cod sand dunes, Mr. J. M. Westgate has the following to say in regard to the cost of planting there:

"The cost of planting depends upon the thickness at which the grass must be set. On the more exposed areas requiring thick setting, five men procuring sets, two teamsters, and eight planters, working nine hours per day, are able to cover an acre in two days. With wages at $2 per day the cost is approximately $65 per acre. This is with an abundance of planting stock growing within a mile of the area to be planted. The thickness of the planting is responsible for the great expense of the operation, but the exposure of the northern slopes to the severe winter gales makes it probable that thinner planting would prove ineffective, at least upon the most exposed areas. The expense is much less on the more protected areas, where the thinner planting suffices, and those having the work in charge state that the 219 acres, covered with grass (at Cape Cod) have been planted at an average cost of $50 per acre."

No data was obtained in regard to the cost of planting on the shore dunes of Michigan, but as the winds are of less severity along the lake shore, the planting of grass would, without doubt, be much less expensive than at Cape Cod. From the limited planting done at Michigan City, St. Joseph, and other places along the shore, it is estimated that grass could be set on these dunes at a distance of 20

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inches or over, for from $20 to $30 per acre. It would be difficult to obtain along the shore sufficient quantities of grass for large plantings, hence it is advised as most economical, to establish small nurseries in protected places and produce the required plants from seed, which could be obtained from France or Germany.

An interesting piece of reclamation work has been accomplished about the city water-works station at Muskegon, Michigan. The pumping station and residence of the engineer were built on the side of a small dune sloping gradually toward the lake, and with an area of about one and a sixth acres. The dune was nearly bare and the sand was constantly moving. To prevent this movement, small squares of fresh sod were laid ontb the sand, in checker-board formation, and firmly pressed down. By keeping this grass thoroughly watered, a perfect covering of sod was soon formed and now all danger of the shifting of the sand is past. The sand encroaching upon the grounds from either side is removed regularly by a stream of water from a fire hose. This method is, of course, too expensive except for yards or grounds of private dwellings or public buildings.

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Fixation by Use of Inert Materials

Sand Fences

The fixation and reclamation of dunes can never be satisfactory or permanent by the use of inert materials alone. Many attempts have been made in this country, and especially along the lake shore, to stop the drifting of sand by the use of sand fences or a covering of brush and debris, but only temporary fixation has been the result. This has shown conclusively that permanency of the dunes can only be secured by the planting of grasses or shrubs and the final establishment of a forest cover. The failure of the Pere Marquette Railroad, along the lake shore, to fully protect their tracks from the encroachment of drifting sand, by use of sand fences alone, has proven the expensiveness and final futility of such methods.

Sand fences, or hurdles, and brush fences, or wattles, have, however, an important use in the fixation of drifting sand. For centuries they have been used in Europe to build up protective dunes and to hold sand temporarily until grasses and trees could be started. It is for these purposes that they will be of the greatest value in this country.

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The Government, railroads, and private individuals, in the sections where dunes occur, have expended large sums in the erection of sand fences, and the fences have subsequently been buried without fulfilling the purpose for which

they were intended. This has been well illustrated at Grand Haven, where the Engineering Corps of the United States Army has built very extensive ranges of fences. These fences were placed on the large dune area south of the harbor, to prevent sand from being blown into the Grand River, where it is quickly carried to the entrance of the harbor and deposited as bars which seriously interfere with navigation. About 1890, over a mile and a half (485 rods) of wooden fences were constructed and placed on the dunes. They were built of heavy timbers in the form of the letter A, and were 12 feet high. Being heavy enough and wide enough at the base, they remained in place without the use of stakes or braces. For the first season the sand was effectually held by these lines of fence, but soon they were entirely covered and as nothing farther was done, the sand moved over them and into the river with as much damage as ever. Often after the fences were entirely covered the wind would act in its old direction, having been influenced by the fence while it was above the surface, and this change would cause the uncovering and often the undermining of the fence with its complete breaking to pieces. This work was done at a large expense and conditions are now worse than before. If immediately upon erection of the fences, the planting of grass and shrubs had been begun, they would have served their purpose and the dunes would now be covered by a permanent vegetation.

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Another example of the attempt to use sand fences for the permanent fixation of shifting sand, which has been followed by almost complete failure, is that of the Pere Marquette Railroad at New Buffalo and St. Joseph and to some extent between these two places. At St. Joseph, as early as 1872, the railroad built several hundred yards of sand fences to protect their tracks. As the fences were covered with sand, new ones were built above them and additions made on either side as the dunes spread over larger areas. Hence, with repairs and the addition of new fences, the cost to the present time has been very large. Besides this, the fences have not held all of the sand, and small amounts are drifting onto the tracks constantly, which requires continual shovelling and shipping away. For a very small per cent of the total cost to the railroad for fence materials and labor since the work began in 1872 all of the dunes along their tracks could have been planted to grass and now have been covered with a forest growth large enough for fence posts and ties.

At New Buffalo the railroad has used worn-out ties as sand fences by simply digging a shallow ditch and placing the ties on end. These fences were successful in holding the sand until entirely covered and the small dune which they had formed there held the sand somewhat, but now the dune has been built up and sand blows directly onto the tracks as before. This kind of a fence could have been used for a long period

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of time by merely lifting the ties upward with a lever, as they became covered. In Europe, planks are used in a similar way for the formation of barrier dunes, and are pried upward with levers as the sand rises over them.

At Muskegon, a sand fence with a hood to the windward has been used. A 6-inch board was fastened along the top of the fence, forming a hood facing the wind. The intention was to turn the wind current backward and downward as its force came against the fence, and prevent it from lifting the sand over. The extra expense of the hood has not been justified by results, as the ordinary fence seems to be just as effective in stopping the sand.

Not only along the lake shore, but on the Atlantic Coast in places and along the Columbia River in Washington and Oregon, these sand fences have been used for the protection of railroad tracks and other property. The conclusion from their use is invariably that they are of great value in holding the moving sand temporarily, but they cannot be relied upon to give permanent results. Their principal value, then, in sand reclamation work is to hold the sand in a quiet state until grasses and forest growth can be started.

In a few places they have been of value in deflecting the wind currents so as to cause sand to be carried in a different course from what it would have taken if left to itself. Thus in several instances small dunes have been entirely

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cleaned away by concentration of the force of the wind between or under fences and the areas kept clear of sand. What can be accomplished in the dissemination or formation of dunes, by using the sand fence as a deflector of wind currents is not fully understood.

The sand fence is also often used to build up barrier or protective dunes for different purposes. This will be discussed later, at some length.

Use of Brush, Soil or Debris

Other inert materials, such as brush and soil or debris, are sometimes used to hold shifting sand. But as with fences, the fixation by these materials is entirely temporary, although if put on in sufficient quantities, they may hold small areas of sand much longer than fences. They also aid greatly in the natural fixation by vegetation, because of the humus which they add to the sand.

On the dunes along the coast of France, brush has been used for many years in the temporary fixation of sand, while the seeds of grasses, shrubs and trees planted through it have been germinating and starting. It is laid on continuously over the surface or in broad rows or squares. Experiments have shown that a continuous covering, even though scattered and open, gives better results than the system of rows or squares. The brush is laid on when in leaf, as the leaves make the covering more effective and also add fertility

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to the sandy soil. Medium-sized or small pieces of brush are used and laid with the length to the wind. A few shovels full of sand are thrown onto the brush here and there to prevent movement by the wind. If a light layer of old soil or manure can be thrown onto the brush, it makes a very permanent covering and hastens the formation of a soil which will quickly induce a natural growth of herbs and shrubs by in-seeding from surrounding vegetation.

At Cape Cod, brush has been used quite extensively for the protection of roadways through the sands and for such very exposed areas as blow-outs and the bare tops of active dunes. It has been found here that the cost of covering with brush is approximately $25 per acre.

The application of brush alone seldom gives satisfactory results, so that seeds of grasses or trees should be sown over the brush-covered areas to hasten the incoming of vegetation. If the seed of such trees as the common locust, tree of Heaven, red and black oaks, Scotch and white pine, beech, basswood and hackberry were planted through the brush they would probably germinate and make a good growth.

The holding of sand by covering with old soil, cinders, manure, sawdust and debris of various sorts, has been practiced both on the Atlantic coast and along the Michigan shore with more or less success. Because of the expense, it has only been done on limited areas where the necessity for fixation of the sand is great.

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At an early date, the sand of an entire dune at Provincetown, Massachusetts, was shipped to Boston for building and other purposes, and the returning ships brought loads of old soil for use in holding sand and forming soil about the houses and in the cemetery.

In the city park at Michigan City, Indiana, manure and cinders have been used with much success to prevent the drifting of sand onto the main boulevard, which runs between ridges of old dunes. Not only has the sand been held by the application of cinders and manure, but the covering by a growth of natural vegetation has been greatly hastened. Cinders have proven much more valuable than manure, though the fertilizing effect is, of course, very much less. Manure dries out quickly and unless weighted down by sand is rapidly blown away, hence this fact, with the ease with which it burns, makes it an unreliable covering. If sand is held with straw, manure, sawdust, or like inflammable materials, a match thrown down by a careless smoker might cause the uncovering of large areas which had been covered at much expense.

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old soil and then planting shrubbery and white poplar. Seed of red clover was also sown on the manured portions, and it caught and grew exceedingly well the first year. This combination of a soil covering of old soil or debris and planting of shrubs and trees, though expensive, brings very rapid and permanent results and can well be used about private residences and on the grounds of public buildings and summer resorts.

Planting of Shrubs and Trees

It is now well understood, both in the dune regions of Europe and at Cape Cod, that shrubs and trees must be planted on the dunes after temporary fixation by grasses to secure permanency. And in Europe not only has a permanent condition of the dunes been secured, but the once desolate wastes of sand have been made to yield good returns in lumber and lesser forest products.

For several years the engineers in control of the dune reclamation work on Cape Cod have realized the futility of planting grass alone and have been growing and planting trees and shrubs. Many species of trees have been tried, but only a few have been found to be adapted to such conditions. These successful ones are pitch pine (Pinus rigida), Austrian pine (Pinus austriaca), and Scotch pine (Pinus sylvestris); black locust (Robinia pseudacacia), and European alder (Alnus glutinosa). Of the shrubs, the common bayberry (Myrica carolinensis) has proven to be the most successful. It will probably

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There are many successful plantings of shrubs and trees on the sand dunes along the Michigan shore. In fact for many years this planting has been going on here and there over the entire dune area from Michigan City to Glen Haven.

At Grand Haven, the common cottonwood (Populus deltoides), has been planted with excellent results. Beginning south of the harbor, at the main pier, and extending to Highland Beach, cuttings of the cottonwood from 1 to 1-1/2 inches in diameter and about 8 inches high were set in rows 15 feet apart, just above high-water mark. A large part of the planting was done 8 years ago, but a little has been done at irregular intervals since. The growth has been vigorous and rapid, and many of the trees are now 25 feet high and from 3 to 4 inches in diameter. The purpose of the planting was ornamental and not to hold the blowing sand, but it shows that these trees can be successfully grown very close to the water's edge in almost pure beach sand, and could be used for holding or binding the sand, if desired.

At Glen Pier, in Allegan County, lombardy poplars were set out in dune sand to protect an orchard. The trees are growing well, but are not near enough together to prevent the drifting of the sand. White poplar planted at this same place is much more effective, having caused the formation of a dune

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12 to 15 feet high, and the tops of the trees are still dense and vigorous. The sprouting habit of this tree makes it very valuable as a sand binder.

Considerable successful planting has been done at Michigan City, Indian, and along the shore in Berrien County, Michigan. At Michigan City, the city park has been partially reclaimed by planting cottonwood, lombardy poplar, red mulberry, and black locust (Robinia pseudacacia). Cuttings of the poplar were used, and in 1903, out of a large number planted during the past two years, only about one per cent were dead. The locust has also been very successful in the reclamation of the park, its growth in sandy, unprotected places being apparently as great as on heavier soils. White pine, red cedar, Scotch pine, and arborvitae have also been successfully grown in the dune sand. These last have given excellent results when used for windbreaks around orchards and farms. The question of the best species of trees for planting on the dunes will be discussed in an appended article on the flora of the Lake Michigan dunes.

Formation of Protective Dunes

In a few places along Lake Michigan where the shores are flat and marshy, there is danger of floods during the high water of winter or during violent storms. The strong lake winds are often very injurious to crops or orchards in the

12 to 15 feet high, and the tops of the trees are still dense and vigorous. The sprouting habit of this tree makes it very valuable as a sand binder.

Considerable successful planting has been done at Michigan City, Indian, and along the shore in Berrien County, Michigan. At Michigan City, the city park has been partially reclaimed by planting cottonwood, lombardy poplar, red mulberry, and black locust (Robinia pseudacacia). Cuttings of the poplar were used, and in 1903, out of a large number planted during the past two years, only about one per cent were dead. The locust has also been very successful in the reclamation of the park, its growth in sandy, unprotected places being apparently as great as on heavier soils. White pine, red cedar, Scotch pine, and arborvitae have also been successfully grown in the dune sand. These last have given excellent results when used for windbreaks around orchards and farms. The question of the best species of trees for planting on the dunes will be discussed in an appended article on the flora of the Lake Michigan dunes.

Formation of Protective Dunes

In a few places along Lake Michigan where the shores are flat and marshy, there is danger of floods during the high water of winter or during violent storms. The strong lake winds are often very injurious to crops or orchards in the

interior. Hence it may be advisable to develop a ridge or dune as a protection against floods and winds. The name best describes those dunes, which are built up by means of sand fences or the planting of grass. After reaching the desired height they are held in place by grasses, or shrubs and trees.

In Holland, these dunes are being constantly built up and kept in repair at great expense, to prevent the encroachment of the sea on cities and farms.

On Cape Cod a protective dune is being formed along the salt marshes near the extreme end of the cape south and west of Provincetown. The purpose here is to keep the sea from over-flowing the salt marshes and covering them with sand.

There are numerous places along the Lake Michigan shore where protective dunes would be of much value. The building up of barrier dunes would be a practical proposition at the mouths of rivers where there are harbors, or between the beach and villages, orchards, and farms, which are now being injured by the encroachment of numerous small dunes.

These dunes can be most easily formed by the use of fences. As the sand rises above these, they can be raised or new fences built, and thus a ridge 25 to 30 feet high be formed. Eventually this ridge should be covered and held by a growth of grasses and trees. It would take from 10 to 20 years to form a dune 30 feet high, depending upon location and severity of wind currents. As soon as the formation was begun, the sand areas in the rear should be planted to grass, and, because

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of the protection of the barrier dune, these interior areas could be reclaimed very easily. Much care is necessary to prevent blow-outs forming and the transportation of the entire barrier dune inland.

After the protective ridge is finally formed and covered with a forest growth, it will not only protect the interior from the further drifting of sand, but will also act as a very effective windbreak, which is so essential for the proper development of the orchards immediately in the rear of the dunes.

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TRANSLATION OF THE REPORT

OF M. BARABAU

INSPECTOR OF FORESTRY

ON THE

FIXATION OF SAND DUNES IN THE SOUTHERN PART

OF THE REGENCY OF TUNIS

By

RAPHAEL ZON

Forest Assistant, Forest Service

1906

R E P O R T

OF M. BARABAU INSPECTOR OF FORESTRY APPOINTED BY THE MINISTER OF AGRICULTURE TO FIND OUT THE ENCROACHMENTS OF THE SANDS ON THE OASES IN THE SOUTHERN PART OF THE REGENCY OF TUNIS

By

RAPHAEL ZON

Forest Assistant, Forest Service

Before passing to the individual study of each oasis and the labor which has appeared necessary to arrest the sand banks, we must seek the general causes which have produced them, and consequently the practical means to combat and arrest them.

The sand banks, which in the form of dunes more or less high and profound, are heaped up at certain points of the border, and even in the interior of the oases--thus threatening with a progressive encroachment the springs, the cultivation and the Ksours themselves--are produced by the influence of two causes, now separated, now united, but tending toward the same result; namely:

On the edge of the sea or in the neighborhood of the Chott, the direct removal of the sand by the action of the wind; everywhere besides the disintegration of the loose superficial part of these dry and strong soils crumbling rap-

idly into a fine sand preeminently changeable, which the wind carries in every direction and necessarily accumulates at the points where the vegetation arrests it and opposes a barrier, that is to say, at the very border of the oasis.

This latter cause is by far the most frequent and most dangerous; the first can be combated by well-known and clearly determined processes. (Those used in the dunes of Gascoigne.)

To battle against the second, the origin must be sought. It is found first, in the impoverished condition and gradual extinction of the springs which are permitted to fill up with sand and disappear for want of cleansing; second, in the lack of cultivation of the oasis which the natives are inclined to abandon; third, and finally, in the incessant pasturage of goats, sheep and dromedaries all around the oasis.

Impoverishing and Extinction of the Springs

The spring is the condition of existence of the oasis; without water, no more cultivation. The oasis not cultivated quickly merges again into the desert.

The supply of the diminishing springs following a constant progression, the part cultivated of the oases becomes less in that portion where the supply diminishes, because of the fact that the point where the source springs or the basin where the water is received, fills up gradually with sand.

When the spring is very far down, the continual falling of the sands, of the banks, caused by the tramplings of the inhabitants and of cattle, finally exhausts the bed down to a level superior to that of the chalky couch on which it reposes; where the water springs even to the surface of the soil, it is gathered into a basin, often insufficient, badly kept, in which an abundant aquatic vegetation develops, and which finally fills up completely with sand, for the trampling of men and of beasts is kept up all around on a soil, in a condition of moving sand, easily caught up and carried by the wind.

Defects of the Culture of the Oasis

One fact is incontestable, that is, that the cultivated portion of the oasis diminishes each day, not including the parts where the mountains of sand have forced the natives to abandon the cultivation of the palms. How many pieces of land we have seen not filled with sand, totally neglected, although the irrigation was sufficient to keep the soil in a fertile state, to the full extent of its productiveness; in other parts, menaced by the sand and which could have been successfully combated by enclosures for the water, (which has been done in several places by intelligent laborers), they have fled from the danger and ceased cultivating the soil it would have been easy to defend.

This soil to-day is waste and bare, is disintegrating little by little; in the absence of all surface vegetation

by pasturage, is changing and becoming for adjacent portions, a new center of sand.

It results clearly from the situation, that the native is tending toward a dislike for the cultivation of his oasis.

Must one see in this fact only the consequences of the failing of the springs' supply? Must it be considered as a result of the idleness and apathy of the native?

Or, finally, is there not another reason in the line of superior or administrative policy, a question of taxes for instance?

It is not this which we seek, however, but that which we ought to testify to is the fact that the labor everywhere is defective.

The springs, well cleaned and well kept, ought to supply the same quantity of water as in the past, for there is nothing to indicate that the hydrologic conditions of these countries have been modified in any degree.

A summary study of the local geology permits it to be affirmed, that it would be impossible to find new springs.

With water, the oases everywhere could be cultivated and even enlarged by means of the land surrounding them, which possesses the same fertility.

The soil, raised to a certain value by means of a shrubby or swampy vegetation, could no more disintegrate under the influence of atmospheric agents; change by the action of the wind and the sand thus fixed would cease to be a permanent menace for the Ksours and for the gardens.

Pasturage around the Oases

The uncultivated lands surrounding the oases, covered with a scant herbaceous vegetation, serve as pasturage for immense herds of goats and sheep.

On the route followed by the caravans from Nifta to Tozeur numerous troops of camels camp the whole year on the pieces of ground adjoining the oases, generally in the proximity of the springs. No bush so thorny as to be free from the tooth of the camel; the goat grazes and snatches the very last herb.

The soil, completely denuded, unceasingly trampled, as if ploughed by the cloven feet of the animals, becomes very loose and each breeze carries the sand in a direction which varies with that of the winds dominant in the region.

This sand encounters the oasis and there accumulates like a palisade.

The immense deserts of sand which surround Tozeur and Nifta are caused by nothing else than the continual passage of goats and dromedaries; and the daily disintegration of the soil caused by this fact can easily be confirmed in the northwest of the oasis of Tozeur, where one can still see gypsum rocks in decomposition, five or six meters high, isolated in the midst of the plain of which they indicate the ancient level.

The abusive use of the grazing around the oases, as well as that practiced in the interior and at the borders of the springs, is the greatest cause of the disintegration and changes of the soil and the consequent sand dunes. It is this plague which must, before all, be remedied.

The causes of the evil being known, the general manner of procedure to combat it may be as follows:

In cases where the sand is carried from the Chotts or the sea, to stop this sand at a certain distance from the oases (about 200 to 400 meters) by plank palisades, which can be raised to a height according with the sand bank, in such a way as to form, by the accumulation of sand, a dune regular, which can be planted with grass and easily made firm as soon as it has attained a sufficient height (about 6 to 8 meters); if planks are lacking, in certain cases being too expensive, by utilizing the branches of palms a wicker fence can be made of the kind the natives use in enclosing their gardens, always being careful to renew this when it becomes covered with sand.

This dune, once well made and fixed, will serve as a protection against wind and sand, will constitute at the same time an enclosure around the oasis causing the soil to be kept covered and in case of need, to insure the planting of grass, and the setting by seeds of local plants, by the planting of tamarinds, and above all by the formal taboo of the entering of cattle.

In the more frequent cases where the sand dunes are formed by simple disintegration of the soil, it will suffice to put all around the changing portions, two or three hundred meters from the oasis, a levee of earth 50 cubic meters to 2 meters in height, on the top of which can be placed, vertically, branches of palms in such a manner as to surround the oasis with a veritable zone of protection, where cattle could not penetrate and in which could be arranged, by means of paths sufficiently large and bordering this enclosure, all the access necessary to the Ksours, the springs, and the oases.

This zone, forming an integral of the oasis, once freed from the devastation of cattle, will be covered spontaneously with a shrubby vegetation, herbaceous and abundant.

The tamarind and the Retem which grow vigorously everywhere in these soils, although constantly mutilated by men and the grazing of cattle, form thickets in whose shelter develops a vegetation, grassy or salsolacees, which will cover the soil and make firm the sand.

The formation of this zone of shelter around the cultivated portions will surely produce the happiest results; it can be made at little cost, and disturbing very little the inveterate customs, which must be reckoned with. The extent of pasturage affected will not be found perceptibly diminished, and the surrounding vast, uncultivated surfaces will always be sufficient.

Moreover, if a struggle must be made against an unintelligent and systematic resistance, the establishment and the strict surveillance of the protective zone must be persevered in as it is the sole, indispensable guarantee of success.

But it does not suffice to stop the disintegration of the soil around the oasis, if it is allowed to take place in the interior by lack of cultivation, as we have been able to verify in many places.

It is necessary then that the entire oasis be cultivated; to succeed in this, the regime of the water must, above all, be regulated; protect the real sources against the sand, find again, by digging, those which have disappeared, search for new ones; make a more uniform, more equitable perhaps, distribution; conduct the water to the portions at present abandoned, thus giving them life with the productive faculty; establish, if necessary, the dams necessary for distributing the water in the portions where the level is raised by the sand and can not be fertilized by the irrigation.

All these results can only be obtained by an obstinate labor of which the natives tend to lose the habit but of which he will certainly be capable the day when he feels that he is called upon to receive the harvest.

The sum of these general measures, with the modifications which certain exceptional situations may impose, and which we will note in the individual study of each oasis, will result in the safeguard of the future.

They will be powerless to repair the harm done in many cases, that which the sand has taken and re-covered with a thick bed is unfortunately lost to cultivation, and all efforts should be confined to limiting the evil and preventing its spread.

There is a plant which is encountered abundantly everywhere; wherever it is, exists a little dampness, on the border of the oueds as well as on the incline and even on the summits of the great white dunes, ten to twelve meters in elevation, on which is always found humidity at some centimeters deep, which spreads easily by propagation, which resists firmly the banks and which nature seems to have placed there expressly to fix and stop the sand. It is the tamarind which ought to be planted around the springs to protect them, at the foot and on the sides of the changing dunes, to arrest them and make them firm; thanks to this precious auxiliary the other local plants, shrubby and herbaceous, take rapid posession of these sands and help to assure their stability.

It is naturally understood that the large, white dunes, accumulated on the borders of certain cases, whatever may be their origin, should in any case be included in the protective zone and the works to be done there must be carefully guarded from the depredation of man and the devastations of animals.

In review, and in general, the means of defense in the partial or total creation of a shelter zone from 200 to 300

meters large around the oases;--This zone limited by a simple enclosure, or by a palisade to be used in case of sand being carried over; the establishment of natural grazing herbage, and ,if necessary,artificial roads in all the shelter-zone with a formal interdiction against the passage of men and animals.

Planting, and cleansing of springs, regulating the regime of the water, earnest and progressive cultivation of the oases, the development of this culture by all the means possible.

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ADDRESS BY ASSOCIATE DIRECTOR ROSCOE E. BELL OF THE BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR, AT THE FARMERS' UNION CONFERENCE, WASHINGTON, D. C., JANUARY 25, 1951.

For Release After 2 P.M., JANUARY 25, 1951.

MANAGEMENT OF UNCLE SAM'S ACRES

It is a pleasure to talk with you who are land managers about land management of Uncle Sam's acres. I need not tell you that good management of land is essential to the economy of our country and to the health and vigor of our communities.

What do I mean by "Uncle Sam's acres?" I refer to the unappropriated public domain land which exists mainly in the 11 Western States. This land--170,000,000 acres of it--is land which remained after the rush of homesteading; after the creation of the national forests; after the creation of reclamation withdrawals; after creation of the national parks and Indian reservations, fish and wildlife reserves, and other Government reservations. You will recall, also, that large grants of land were made to the States for schools and to the railroads for railway construction. Yet after all of this land had been taken for other purposes, there still remains in the United States about 170,000,000 acres of unappropriated, unreserved public domain.

This public domain land is generally thought of as being tag ends of no-good lands, lands that nobody wanted. For that reason these acres were for many years overlooked and even abused. Today we are having a new kind of land rush, a rush for the use of the minerals under the land, principally oil and gas, but also phosphate, potash, sulfur, coal and sodium. These minerals are known as the leaseable minerals which can be used, under the Mineral Leasing Act, by individuals for private industry. The surface uses of the lands are now also in great demand because of the forage and timber they produce. These are mainly lands, the use of which has been regularized under the Taylor Grazing Act. The grazing lands have

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a very important part to play in livestock production in the Western States. As the demand for livestock products increases with rising population in the Western States, as well as in the Nation as a whole, the role of the western grazing lands becomes of even greater importance to all of us.

I have mentioned briefly a few facts about the Bureau of Land Management program--homesteading, mineral leasing, grazing and forestry activities. Let us look at the larger job of the Bureau of Land Management. This job consists of management of the surface resources of the whole public domain, 170,000,000 acres in the continental United States; 325,000,000 in Alaska; or in round figures, 500 million acres. In addition, we manage the mineral acres totalling around 780,000,000 acres. This Bureau also has responsibility for the mineral resources and their administration under all of the lands which are in public ownership, including land in national forests, military reservations, etc. This you will appreciate is a sizeable land-management job.

Another important part of the Bureau of Land Management's responsibility is maintaining the land titles and surveying records. The land title records are the original link in the chain of title to real estate transactions, both private and Federal. The surveying records are basic to any mineral or other use of the public lands. A little later I'll tell you more about these records and their importance to you as a land owner.

Since many of you people come from States where there is very little public land left, namely North and South Dakota, Minnesota, and eastern Montana, you may wonder of what importance is this whole discussion to you.

The importance of the public land to you as individuals is two-fold; one, these lands constitute a source of revenue to the Federal Government which far

[illegible] important part to play in livestock production in the Western States. As the demand for livestock products increases with rising population in the Western States, we will be to the Nation as a whole, the role of the western grazing lands becomes of most greater importance to all of us.

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The importance of the public land to you as individuals is two-fold; one, these lands constitute a source of revenue to the Federal Government which far

exceeds the cost of administering the lands. As a matter of fact, in recent years about $7.00 in revenue has been returned to the Federal Treasury for every dollar appropriated for the management of these lands. That is a unique record in Government administration of public resources and we are proud of it!

You, as land managers are fully aware that it often takes money to make money. If we are going to conserve, develop and in some places restore these lands for present and future needs, we will have to expend more money and manpower to do a real job. We are sure that the expenditure of several millions of dollars more each year on our public land might well return to the public purse not less than three dollars for every dollar expended.

You will appreciate how thin our manpower is now scattered when I tell you that on an average, our range managers have close to 10,000,000 acres for every man working in this field. Ten million acres for one man to travel over and manage is a very sizeable acreage even though the job of management is not very intensive.

The second point of keen interest to you about the public lands and their resources is the minerals contained in these lands. Of particular interest are the fertilizer minerals, phosphate and potash. You have, of course, other direct interests in the public land management that I will call to your attention briefly. The public lands are watershed lands, thus their management has a bearing on the water supply, the purity of the water, the amount of silt it contains, the regularity of stream flow, and its value for power development. Much of the public land is low-lying land which unfortunately contributes in many cases more silt than water. You are very definitely interested, then, in the control of that silt so that it won't sweep away your top soil and muddy your streams and reservoirs.

We have done some very outstanding work in eastern Montana on control of water. The folks out there use the expression, "slowing the run-off down to a walk," putting the water to work on the land to produce more grass. Actually through control of water, poor range lands are being converted into good meadow lands.

I think most of you are interested in another responsibility of the public lands--the wildlife. The game population of the public lands under our management is very considerable. Water developments used by livestock on the range also serve as watering places for big game, and resting places for ducks and other water fowl, so that your interest as sportsmen, (if you or farmers get the chance to participate in sports) will be considerable.

Another aspect of our program that you very soldom think about is the public land records, which I have mentioned briefly as one of the Bureau of Land Management's responsibilities. Let me explain the importance of these records more fully.

Most of you are on farms which either you, your parents or grandparents, or someone else homesteaded originally. That land was surveyed and the corners marked. The title to that land passed from the Government to the individual, but the chain of title started in the United States. We have in our files here in Washington copies of all of the patents which were ever issued for public land, so that in tracing title to your land, the first step of title is that transfer, that patent from the United States to whoever received title first. Each week we get hundreds of requests for copies of these records to complete the chain of title necessary in real estate transfers.

We now have started a project of microfilming these indispensable records containing millions of patents to lands, in order to place a copy of each valuable

land record in a place somewhere outside of Washington for safekeeping. Unfortunately our microfilming program has been delayed by the current defense effort rather than stimulated as we feel it should be.

Now, let's look at a few more of the Bureau of Land Management's responsibilities. In the area where you live we still have responsibility for management of scattered tracts, quarter sections, half sections, and forties of Government land that has never passed into private ownership. We are moving as rapidly as we can on a program of disposing of this land--land that is too scattered to be economically manageable. We feel these scattered acres should be transferred to private ownership where they will undoubtedly receive better management than we could give with our limited manpower. The total amount of this scattered land probably does not exceed three or four million acres in the country as a whole.

The land which is blocked up and remains in public ownership, probably can best be managed in the grazing districts which constitute an outstanding example of cooperation between the users of the range and the Federal Government in bringing about good management and range improvement to stabilize the livestock industry dependent upon it.

Of additional interest to you are the 30½ million acres of forest and woodlands on public domain lands. These wooded areas are of importance, of course, as part of the watershed. They are also a part of the commercially important forests and woodlands that supply you with lumber products and fence posts.

Mr. Stong asked me to talk to you about one particular aspect of land management in a little more detail. I refer to the phosphate fertilizer industry.

It was my privilege a few years ago to make a rather intensive study of the western phosphate industry and how the phosphate resources of the West might better

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It was my privilege a few years ago to make a rather intensive study of the
n phosphate industry and how the phosphate resources of the West might better

be used in the interest of the farmers of our Nation. I will tell you some of the highlights of these studies.

The Nation's natural phosphate rock resources are located principally in three areas: Tennessee, Florida and the western fields of Idaho, Montana, Wyoming, and Utah. The map shows that 60 percent or more of the Nation's supply of phosphate lies in the western fields and yet this 60 percent has scarcely been touched for fertilizer and chemicals to supply the Nation's needs. Since about 80 percent of this phosphate lies on public land it is a responsibility of ours in the Bureau of Land Management to manage the land so that it is developed to meet the Nation's needs.

Studies have shown that all throughout World War II and in the period following World War II, the western area which might best be served, transportation wise, from western phosphate deposits were receiving phosphate mined in Florida, shipped to Maryland or other points where it was manufactured into superphosphate. Then it was shipped to the west coast and distributed through the western area adjacent to the greatest deposits of phosphate in the Nation, if not the world. Obviously, this roundabout delivery of fertilizer to your farm costs you money and it further overloads our transportation systems during time of war or other national emergency.

Because your farms are in States which are far removed from any of the sources of phosphate your natural question is, "How can I get fertilizer the cheapest, and from what source?" The West is your natural source of supply, providing, of course, that phosphate fertilizer can be produced as cheaply in the West as it can at the other points.

If fertilizer must be hauled long distances, the greatest savings to farmers can be made by the use of concentrated fertilizer. Most of you are familiar with

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concentrated phosphate fertilizers, that is the triple or treble superphosphate or the ammonium phosphate. You also know that ordinary superphosphate has only about half the plant food that the triple superphosphate has, therefore, the freight cost per ton of this plant food is consequently much greater.

The cost of storing, handling, bags and bagging--all of these factors make the cost per unit of plant food in ordinary superphosphate higher than triple superphosphate. Thus it is that in your area the average cost per ton of phosphate plant food is about $30.00 greater in the form of ordinary superphosphate than in the form of triple superphosphate. Since all of the phosphate fertilizer must move great distances, it is extremely important that concentrated fertilizer be produced in your areas.

This fertilizer can be produced by two processes, either a furnace process (and the electric furnace is the most successful) or a sulfuric acid process. If sulfuric acid is available at low cost at some of the smelters that is the cheapest method of fertilizer production under our present economic conditions. Sulfuric acid supplies have not been adequate although more supplies can be developed. The only difficulty is that in times of national stress other demands for sulfuric acid increase. We are in that situation now. It is probable that because of greater demands elsewhere insufficient sulfuric acid will remain available for use in the production of fertilizer.

Most of the phosphate fertilizer used in this country is ordinary superphosphate which is produced by the sulfuric acid method. There is only one electric furnace phosphate fertilizer producer in the United States, the Tennessee Valley Authority. Other electric furnace phosphorus plants have been developed in recent years for production of phosphorus chemicals. The two new developments in the West are in Pocatello, Idaho, and in Silverbow, Montana. The one in Silverbow is under

construction now and will be in production in 1951. Unfortunately for fertilizer users both of these plants are producing chemical phosphorus rather than fertilizer phosphorus.

The plants could be converted to produce fertilizer phosphorus, but the demand for phosphorus in the chemical industry has been increasing by leaps and bounds, especially since it has a wide variety of uses from incendiary bombs to toothpaste and Coca-Cola. The detergent industry manufacturing the washing powders and cleaning agents your wives use for housekeeping, is one of the big consumers of chemical phosphorus. During wartime, phosphorus is used for smoke screens, incendiary bombs and other military uses.

Now let's look ahead at the fertilizer possibilities in your States. As you know, added power developments are being made in the West, in the Columbia Valley, in the Missouri Valley, and that these power supplies might become available for fertilizer production. You are wondering, "Is that capacity needed?" "What effect will it have on the cost of fertilizer, and how will it meet our needs for fertilizer?"

I need not tell you that the need for fertilizer is increasing for you know that the once rich, virgin prairie lands of your States have been cropped over a period of years with consequent loss of soil fertility. You know that phosphorus is contained in the seed grains which you sell from the farm. It is also contained in the milk or beef or animal products which go from your farm, so that there is all in all a net drain on the phosphorus supply in the soil. Commercial fertilizer is the only means of replenishing that supply.

At this point, I would like to point out the the relationship between fertilizer use, removal of fertilizer from the soil by crops and the probable estimated need for fertilizer. The following table tells the story:

PHOSPHATE FERTILIZER: Consumption, Need, Removal from the soil by crops and western manufacturing capacity

Phosphate Fertilizer Use in Tons of P_2O_5 *

	United States	17 Western States	North Dakota	South Dakota	Minnesota	Montana
Average 1935-39	703,926	37,338	174	67	1,827	1,669
1944	1,288,302	135,172	763	192	13,292	3,075
1949	1,920,834	292,147	5,051	1,652	52,418	2,737
Phosphate Fertilizer Need*						
	2,863,296	457,142	4,521	9,500	53,500	7,240
Phosphate Fertilizer Removal from Soil by Crops*						
	1,699,046	869,829	85,678	49,478	98,812	39,785

Estimated Phosphate Fertilizer Manufacturing Capacity - 1948

Ordinary Superphosphate	- 137,000
Conc. Phosphate	- 80,000
Total	217,000

*U.S.D.A. Figures

In the State of Minnesota between 98,000 and 100,000 tons of phosphate plant food is removed annually in crops. In 1949 about 52,000 tons were returned in fertilizer. It has been estimated that the annual need of between 50,000 and 60,000 tons is a figure which represents that which it would pay to use for immediate crop production. Thus, in the State of Minnesota, the fertilizer use is approaching the estimated total tonnage needed to produce crops economically. Undoubtedly, more fertilizer is being used on some fields than is absolutely necessary and some farms are not receiving the fertilizer they need, but on the whole the picture in Minnesota does not look too bleak. As time goes on, however,

PHOSPHATE FERTILIZER: Consumption, Food, Removal
from the soil by crops and western manufacturing capacity

Phosphate Fertilizer Use in Tons of P_2O_5 *

United States	17 Western States	North Dakota	South Dakota	Minnesota	Montana
703,926	37,338	124	67	1,627	1,669
1,289,302	135,172	743	192	13,238	3,075
1,920,834	504,147	5,051	1,662	52,418	2,737

Phosphate Fertilizer Need*

2,867,296	467,142	4,[illegible]	2,300	53,500	7,240

Phosphate Fertilizer Removal from Soil by Crops*

1,899,046	967,629	86,678	49,476	98,912	39,765

Estimated Phosphate Fertilizer Manufacturing Capacity - 1946

Ordinary Superphosphate	127,000
Conc. Phosphate	90,000
Total	217,000

A.D.A. Figures

In the State of Minnesota between 98,000 and 100,000 tons of phosphate plant
is removed annually in crops. In 1946 about 52,000 tons were returned in
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it is undoubtedly true that the annual fertilizer needs in the State of Minnesota will increase to approximately the total removal by crops. As a matter of fact, the above estimated need made five years ago is out of date now.

In North and South Dakota and Montana the use of fertilizer does not come anywhere near the annual removal of crops. The total phosphate plant food removal from Montana soil is 39,000 tons whereas the annual use is less than 3,000 tons. The immediate need is 2½ times this amount.

In North and South Dakota a similar situation to that of Montana exists, with an annual removal in North Dakota of 85,000 tons and a return of approximately 5,000 tons. In South Dakota around 50,000 tons is removed from the soil annually and less than 2,000 tons is returned in the form of fertilizer. This may not be too serious a situation at the present, because of the high natural soil fertility. But looking to the future, as the soils become more and more depleted, greater additions of fertilizer will undoubtedly become necessary. This is particularly true if we start to irrigate larger acreages. The accelerated crop growth removes more plant food and increases demand for fertilizer.

The picture in the entire western area which might be served from the western phosphate deposits is somewhat similar. Roughly, 300,000 tons of fertilizer are being returned annually to these soils. The estimated need is around 450,000 tons and the total removal from the soil by crops is more nearly 800,000 tons. The present western manufacturing capacity for phosphate fertilizer is only about 220,000 tons. About two-thirds of that capacity is in low analysis, ordinary superphosphate fertilizer. So a look ahead makes it very clear that there is now a need for more concentrated fertilizer manufacturing capacity and there will be much greater requirement for fertilizer manufacturing capacity in the future.

What kind of manufacturing capacity should this be? As I pointed out earlier, it should be capacity that will produce high analysis fertilizer to help beat high cost of freight. I also pointed out that it appears unlikely that sufficient additional sulfuric acid will be produced in the Western States to meet the needs by the sulfuric acid method. This indicates that we may have to depend more on the electric furnace method for producing concentrated phosphate fertilizers in the West. Hydroelectric power from our streams appears to provide an answer for future production of fertilizer. It takes low cost power, to produce fertilizer cheaply enough to make it interesting for industry to develop.

We, in the Bureau of Land Management, are interested in seeing the phosphate mineral resources developed to meet the agricultural and industrial needs of a large western area. Increased development of plant foods will require the production of additional low-cost hydroelectric power. Continued functioning of power projects is dependent on the proper management of the watershed lands, many of which are under our administration and jurisdiction. The topic of better conservation of range lands in the interest of the farmers is a full discussion in itself.

Your immediate monetary interest in seeing the development of western resources lies in the fact that through the production of concentrated fertilizer you can save about $30.00 per ton of plant food, which for the State of Minnesota in 1949 would total more than $1,500,000.00 in reduction in the annual phosphate fertilizer bill. Other States are in more or less degree comparable. Minnesota, by comparison with North Dakota, is a large consumer of fertilizer. The phosphorus taken from the crops in Iowa, is almost double that taken from the soil by crops in Minnesota, because almost every acre of the State of Iowa is in farm land and is used for intensive production of crops of one kind or another. I have discussed

phosphate in some detail. The Bureau of Land Management has similar responsibilities and a similar interest in the development of potash--much of which also occurs on public land in New Mexico, California and Utah.

It has been a pleasure to talk with you who are land managers, about some of the problems of land management of Uncle Sam's acres. We are proud of our record of conservation with a profit and we are looking forward to continued improvement of our service to you and the public in general. We hope to give better service through better conservation of watershed lands, better utilization and improvement of our range and forest lands, better service through improved public land surveys and improved land title records of those lands which originated in the public domain. We hope to help private industry achieve more complete development of mineral resources to serve the agricultural and industrial economy of the Nation.

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CONSERVATION AND THE GOOD SOCIETY *

John D. Black

I take it for granted that the good society you are searching out in this Great Issues course at Dartmouth is a good society for the coming generations as well as for our own. Otherwise the subject of Conservation would not have been included in it. Conservation in the simplest and most meaningful sense of the term is planning for future generations. The opposite of planning is drifting. If we merely drift, it may happen that the levels of living of future generations will be lower than our own. The good society of the future must have levels of living at least as high as our own.

What I am going to discuss with you are the realities of this conservation planning job. I shall try to help you to a true understanding of its fundamentals and then show what it means in actual human affairs. I shall not take any time to convince you of the importance of this planning for the future. Others have done this abundantly; otherwise you would not be having conservation in this program.

In society's efforts to deal with its problems, one needs to distinguish three necessary functions. One of these is best called publicity, that is, bringing important issues and problems that need attention before the public so that they will get this attention. A second function is education, that is helping the responsible members of society to a true understanding of the problems. The responsible members are not just those holding public offices; included more importantly is the great body of socially literate persons who are the real leaders of humanity, whom the rank and file unconsciously accept as leaders. The third function is that of working out the programs of

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* A speech presented as part of the Great Issues Course at Dartmouth College, Hanover, New Hampshire, November 14-15, 1949.

needed action and executing these. Men like Fairfield Osborn and William Vogt are publicists. Their function is attention-getting. Their recent books Our Plundered Planet and The Road to Survival, serve this purpose admirably. For the true understanding of conservation that is necessary as a basis for policy-making, planning and action, however, one must look to the educators. Men like Osborn and Vogt may presume to give their readers this understanding. But they can hardly do so, since they do not have it themselves. If they did, they could not write as they do.

What a marvelous publicity subject they have! One can scarcely look anywhere without seeing evidence of seeming destruction of natural resources, of virgin forests logged off and not restocking, of coal seams or beds of ore mined out, of hillsides deeply gullied. Look further afield in parts of the Old World and one may see apparencies of ancient civilizations lost to the ravages of waste and time. The imagination needs to take only one more flight and who knows how many of the starry planets are now nothing but barren waste because of heedless exploitation by some living race of inhabitants!

My function today and tomorrow is an educational one. Your function as graduates of Dartmouth College will be that which I have broadly called education -- not as professional educators in most cases, but as the responsible members of society who are its real leaders, and who furnish the understanding which is so necessary to sound policy, planning, and action.

Before I set forth on this undertaking, however, I must caution you about two words freely used in all discussions of conservation, namely exploit and deplete. They connote evil in the minds of many conservationists, and also in the minds of much of the populace. Yet both of these can be, and usually are, highly social processes. If we are not to exploit or deplete, we shall never mine a single ton of coal or of iron ore, or grow a single crop on virgin prairie soil. It is only when these are at too rapid a rate, or wastefully

done, that any social evil is perpetrated. I shall use them very circumspectly in what I say following.

I have just used the word "wastefully." This too is dangerous. The term waste is another example of a word in common usage that needs more precise definition if it is to be put to scientific use. In popular use, anything that is not utilized is wasted, regardless of the costs involved in putting it to use. Think of the iron and tin wasted in this sense in the tin cans collected at our back doors. An excellent illustration of the principle involved comes from mining. As the ore is removed from a lode, the overhanging rock strata commonly need to be supported if the remainder of the lode is to be exploited. The simplest way of doing this is to leave supporting pillars of the ore at safe intervals. Alternatives are to build in temporary timber supports or more permanent concrete pillars, or pump in sand from the surface. Suppose, however, that all of these cost more than the ore in the pillars is worth. These costs include the use of other resources as well as labor. Here is a possible conflict between the private and the public interest, of which I shall say more later. Perhaps a hundred years from now, the nation may have such great need for this ore that it would have been wise to have substituted artificial supports for the pillars when the lode was exploited. But who is likely to be in position to know this definitely at this time? Much of the time, therefore, we can not now know whether or not a given practice will prove to be wasteful. Surely, however, we must not condemn all failure to utilize every scrap of a natural resource as wasteful.

By the same sign, who knows that we are really wasting the top-soil now that could be saved by keeping more land under grass and reducing the current output of wheat and corn? or by building conservation structures that do not pay for themselves in the short run?

Most of my illustrations will, however, be taken from agriculture and forestry, because it is these I know best -- although I once spent four whole years in a college of mines. The planning principles involved can all be stated in terms of agriculture and forestry. It is mainly in terms of these moreover, that Osborn and Vogt have raised the issue.

I hope you young men will understand if an oldster like myself has not been greatly perturbed by the reading of these two books. Please remember that we oldsters lived through an earlier period of great concern over conservation -- the Theodore Roosevelt-Gifford Pinchot period. In that period, the president of my alma mater, the University of Wisconsin, Charles R. Van Hise, a geologist, wrote a good book on The Conservation of the Natural Resources of the United States (1910). This book was a principal subject of discussion when I was a graduate student at the University of Wisconsin in 1915-18; and in 1917 two of its professors of economics, Richard T. Ely and Ralph Hess, and Thomas Carver of Harvard, and another Wisconsin geologist, Charles K. Leith, wrote a book called The Foundations of Our National Prosperity which was more or less of a reply to the Van Hise document.

It may be of interest to you that President Van Hise almost failed in 1916 of reappointment to another five-year term because of his authorship of this book. The then chairman of the University's Board of Regents, Ex-Governor William D. Hoard, attacked the book strongly because it did not say enough about the conservation of the soil. Hoard, a fellow-townsman of mine, the founder of what is still our leading dairy journal, Hoard's Dairyman, was a thoroughgoing physiocrat, believing that all wealth comes out of the soil and that only agriculture is truly productive. Hoard did not get this philosophy out of any book. Almost entirely self-educated, he evolved it out of his own contemplations. Without benefit of the economic thinking of his

predecessors, he arrived in his own philosophic growth to the point that the economic thinking of Europe had reached in the 18th Century.

Osborn and Vogt, so far as they have any economic philosophy at all, are essentially physiocrats. Thus Osborn talks much of the "economy of nature," of this economy of nature as the only true economy. Man is the great destroyer. He writes, "We must be prepared to accept the concept that man, like all other living things, is part of one great biological scheme." (p. 196). And if man does not fit into this scheme, woe to man. To conceive of man as controlling nature seems preposterous to Osborn.

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The most important single factor in society's planning for its future generations is the size of the future population. Vogt and Osborn recognize this. Indeed the population factor furnishes most of the drama in Vogt's book. I am sure that most of what needs to be said on this subject was presented in last week's sessions. However, I am not sure that the interrelations of the population and the conservation problems have been adequately developed, and this is a subject with which I have been concerned over most of my academic years. While I was a graduate student at the University of Wisconsin in 1915-18 I engaged in the current discussions of it, in particular taking part in Professor E. A. Ross's seminar that was popularly known on the campus as his "fecundity seminar," out of which grew eventually his book Standing Room Only, which was the population-alarm book of his day. Professor Ross used to say, "The enemy of the dove of peace is not the warlike eagle, but the stork." When I came to Harvard in 1927 I was brought into contact with Professor Edward M. East, the great geneticist, whose book Mankind at the Crossroads was the population-alarm book of the next decade. Professor East got interested in population while helping Herbert Hoover run the

War Food Administration during the First World War. He visualized the human race sinking to a Malthusian level within a century if something drastic was not done to prevent it. Professor East was one of the group that organized, following World War I, the International Association for the Scientific Investigation of Population Problems, and he was the first chairman of its Commission I on Food Supply and Population. When he became bowed down with his genetics research again, he transferred this Commission I to me and we started a research project here at Harvard on the analysis of world data on population and food supply. The American chapter in the International Population Union is called the Population Association of America. Its last session at Princeton University (May 1949) was devoted to Population and Scarce Food Resources, and some of what I am presenting you today is drawn from the paper which I read on that occasion.

Although in what follows I may say a number of things that may seem to discount the extravagant statements made by men like Ross, East, Osborn and Vogt, let no one conclude that I don't rate the population problem as one of the great issues of the day. I know of no subject facing the world that needs more attention at this time. The international organizations that have been set up since the war devote altogether too little attention to the population factor. All that the FAO may hope to achieve in the way of more effective use of the world's food producing resources can easily be more than offset by a high net increase in the population of the densely populated agricultural countries. Yet the subject received little attention at the Hot Springs Conference out of which FAO grew, and at the recent United Nations Conference on the Conservation and Utilization of Resources (UNSCUR). At Lake Success, Colin Clark read about the only paper on the subject. (I brought it into my rather rigorous review of Stephen Raushenbush's paper.)

The elements in the population problem that need to be brought to the fore when it is related to conservation can be stated very simply as follows:

1. The realistic, and at the same time understandable, way in which to look at the population phase of our problem is in terms of two rates of growth, one of population and the other of progress in the arts. If the arts advance faster than the population, as in western Europe since early in the Industrial Revolution, planes of living are sure to be rising. If, contrariwise, the population is advancing at a faster rate than the arts, planes of living are sure to be declining. This latter does not happen very often, and then only for short periods, such as following World War I, or similar disasters in the densely populated agricultural civilizations. However, the population and the arts may be advancing closely in parallel with slight departures either way for short periods. Or a population may be stationary for several centuries, as in China for several centuries before the new growth set in in the last century.

2. We must look at the population problem not only in terms of a comparison of these two rates of growth, but in terms of such a comparison country by country in the main. To combine the United States and India into one total for such an analysis is meaningless because the United States is not going to send much free food to India, and India is not going to be able to buy much food from the United States, or, for that matter, from any other countries. India's buying power for food is determined by the amount of jute, cotton, and tea which she can produce and find an outside market for and the amount of manufactured products that she can sell abroad. The exports of jute and cotton are already declining. India, like other agricultural countries now struggling desperately to industrialize, will need to find most of her market for these products among her own families as their levels of living

rise with increasing output per worker. A similar situation confronts China and other Oriental countries. Japan did develop a sizeable export market for silk and cotton goods before World War II, but both of these have largely vanished. When the problem in hand is analyzed country by country as I have just done it for the United States and India, the conclusion is quickly reached that the balance between the rates of population growth and progress in the arts needs to be achieved mainly country by country, not for the world as one unit. The nations united under FAO can help each other to achieve this balance; but only to a very limited extent by free distribution of surplus foods.

3. Proceeding along the foregoing lines, let us consider the relation of the balance of these two rates of growth to conservation, first, for the United States and then for several other sample countries. As for the United States, the progress of the arts of production has been faster than the population growth almost from the time of the Revolution, if not earlier. Coupled with this, there have been new virgin resources available for further exploitation. Toward the end of the last century, the new lands of the United States with cultivable soils seemed to be about exhausted. Progress in the arts since then, however, has given us a rapid expansion of agricultural output since the beginning of World War I. The progress of the arts has included discovering how to maintain the productivity of our soils as well as to increase the yields from them. We now know how to conserve our soils, and it is almost inconceivable that we will not apply this information.

Highly pertinent in this connection is what General Francis A. Walker, the foremost American economist of his time, wrote, in his preface to the 1890 Census of Agriculture:

> "Down to this time our apparently wasteful culture has, as I have sought to show, been the true economy of the national strength; our

apparent abuse of the capital fund of the country has, in fact, directed the highest possible improvements of the public patrimony. Thirty-eight noble states, in an indissoluble union, are the ample justification of this policy. Their schoolhouses and churches, their shops and factories, their roads and bridges, their railways and warehouses, are the fruits of the characteristic American agriculture of the past.

"But from a time not far distant, if indeed it has not already arrived, a continuance in this policy will be, not the improvement of our patrimony, but the impoverishment of our posterity."

If General Walker had been writing a preface to the Census of 1940, he might have written in precisely the same vein, again saying that the exploitation of the past had been sound national economic policy, but that the point has now been reached, or is not now far distant, when we must change our ways or posterity will suffer. Conceivably some commentator another sixty years from now will be moved to write in the same way.

As to the growth of population on the other side of the balance, it is commonly agreed that the population of the United States at its peak will be larger than was predicted by the scholars in this field before the war. They made the mistake of lowering their prediction rates of net increase because of the falling off in birth rates during the depression years of the 1930's, not recognizing that abnormal conditions were causing this. There is a similar tendency for some now to predict too large a population on the basis of the rates of net increase since 1940. There will be a dip in the birth rates and net increases before long, but we do not know how low the rates will fall. It does not seem plausible to plan for more than 200 - 250 millions as the peak figure. Given such an increase, there is little doubt as to our ability to advance the arts of agricultural production faster than the population increase.

India. The population of India has been growing at a tremendous rate since 1920 -- an aggregate increase of 83 millions, or more than 1 per cent a

year. Why this large increase? In part it is merely an offset for the very slight increase in preceding decades. Losses from disease were very large during these earlier decades. The influenza epidemic of World War I years is commonly credited with 10 million deaths. The expectancy of life at birth in India was around twenty-six years in 1880. It had arisen but little above this level by 1930. It has gained considerably since 1930. The falling death rates have made possible a large growth in population, but these could not have occurred if there had not been some increase in output of food per person over the whole period.

In general, however, yields of crops per acre in India have been highly stable for a long time. At the Rothamstead Experiment Station in England, wheat has been grown continuously on the same plots since 1842 with no additions of fertilizer. The yields have declined to a level of seven or eight bushels per acre. This represents the rate at which the mineral plant foods in the upper subsoil combined with the decaying crop residues and the plant nutrients deposited along with rainfall, make plant nutrients available for the growth of wheat. On much of the area of India, yields of rice and other crops closely approximate levels equivalent to those of the Rothamstead plots. However, in the decades from 1880 on, an appreciable acreage of new land was irrigated or brought into cultivation and this made possible more food to support more people. It is not likely, under the foregoing circumstances, that population pressure will cause any further abuse of the lands. The one possibility is that water power will be used to produce cheap nitrogen by electrolytic processes, and this used as commercial fertilizer without complements of potash and phosphate will unbalance the soil.

If new technology is not introduced into India, the population growth will slacken in the near future, and slacken still more as the years go by.

Imports of food have been increasing importantly over the past five years, these foods being purchased out of sterling balances that were accumulated during the period of military occupation of India. These balances will not last much longer.

A more reasonable expectation is that additional fertilizer will be made available and new techniques will be introduced, and the arts of production will be advanced at an increasing rate, and that at some time not too far off the arts will begin to gain faster than the population. I have asked each Indian whom I have met at FAO and other meetings how soon they think the point will be reached where the two rates come in balance and planes of living will begin to rise. Of course they hesitate to answer, but when I try out the suggestion of fifty years, all of them think this is too long. Twenty to thirty years represents about the mean of their answers.

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At this point it will be well to consider how population decline comes about in a country. The answer is that it comes about family by family and not in the form of one general decline in birth rates. A small percentage of the families of India are already keeping the number of children down to the level where they can provide them with proper food, clothing and health and a certain amount of education. I have asked these Indians and all my students from India to give me their guess as to how large the percentage of families is that is doing this. Their answers range from five to fifteen per cent. A similar question put to students in United States gives a range of from fifty to seventy-five per cent. There are of course no actual statistics on this point available in either country. In both countries the percentage is increasing. It is in this way that population growth is eventually put under control.

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Puerto Rico. The population growth of Puerto Rico had almost ceased in 1898 when United States took over the government of the Island. The population has doubled since then. The sugarcane export of the Island was 50,000 tons in 1898. The quota for 1949 is 920,000 tons. These additional exports have bought enough rice, beans and salt fish from the United States to make possible a doubling of the population. Half of the Island's food supply is imported mostly in the form of these three foods. The wages on the sugar plantations have made it possible for cane workers' families to buy the rice, beans, and salt fish.

The Puerto Rican sugarcane quota is not expected to be increased. The other exports of the Island, coffee, tobacco, pineapples, and grapefruit have been declining. The arts of agricultural production can to a considerable extent restore some of these lines of production and increase the domestic food supply so that perhaps 250,000 more farm people can be supported on the land. Industrialization has definite limits, 50,000 being employed in the industries at present. The maximum now being estimated is 250,000. The 500,000 more persons supported by these additional industrial workers combined with the 250,000, will make possible an increase of 40 per cent in the population.

But will the gains in the arts keep up with the growth in population? They may or may not. The answer depends more largely upon how fast education can be extended to all of the children than upon any other factor. Industrialization with its accompanying urbanization will also help. The number of children born to completed families of women with education beyond the sixth grade is little more than half that of the average, and comparable figures for urban women are only a little more than half those for farm women. The number of women who want to keep their families to reasonable limits is increasing rapidly with education and improved public health measures.

Europe. Only in a few sections of Europe has there been a net deterioration of soil in the last few centuries. The declines that have occurred in some periods have been more than offset afterwards in most areas. Fields in Europe that have been farmed for 500 to 1000 years are as productive today as in any time in their history. The population scholars are predicting that the growth of population in Europe exclusive of Russia will level out on the average before the year 2000.

The Old Civilizations. The statements commonly made by conservationists to the effect that parts of the Near East, North Africa, and so forth have become abandoned as a result of continuous exploitation of the land are generally questioned by students of history. The theory Simkovitch presented in his Hay and History are generally scoffed at today. The lost civilizations suffered severely from military conquest. It seems to be agreed by climatologists that the rainfall of North Africa has been going through a long sequence of decline.

Furthermore even though some of these civilizations vanished because of neglect of the land, if the progress of agricultural science in the last hundred years means anything at all, it will prevent an occurrence of such a catastrophe.

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The sane way in which to evaluate the world situation in terms of population growth and food supply is therefore in terms of the percentage of the population of the world which is living in countries where the arts of production are advancing faster than the population. Howard Tolley of the staff of FAO, in his paper in a symposium under the title of Freedom from Want before the Association for the Advancement of Science made an estimate of 40 per cent for this figure. If one accepts small net gains and the data assembled by Colin Clark in his Conditions of Economic Progress, the

figure may range as high as sixty per cent. Whichever percentage is accepted, we have every reason to expect that it will enlarge within countries family by family, until the average for country after country is a net gain, and that the net gains for the forty or sixty per cent will be increasing.

Obviously there is a great danger of analyzing this problem in terms of world totals as Osborn and Vogt have done. Norris Dodd, Director General of FAO, was talking last year to the effect that 55,000 new mouths were sitting down to breakfast each morning somewhere in the world. This surely was thinking in terms of world totals. Criticized for this form of statement, he is now making a new one to the effect that more persons go to bed hungry each night than the night before.

This latter statement has a fair chance of being true for the next decade or so because the large populations of the world are in countries living at the Malthusian level, and the progress of science is reducing the death rates in these countries faster than the birth rates and the increase in food supply. This means that fewer will die of specific diseases and proportionately more will die because of malnutrition and hunger as such. This creates a critical situation. But it is one in which conservation is very little involved, since it is not the abuse of nature's resources that will cause this situation. The solution will have to take the form of increasing the number of families that keep the number of children within reasonable control.

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The second main factor in our problem is best introduced in terms of the familiar maxim of the conservationists that true conservation requires "each generation to hand down to the next an undiminished patrimony." This

is popularly understood to mean an undiminished patrimony of natural resources. Understood as such, however, it makes no sense. Otherwise, as I stated before, we would not be able to mine a single ton of coal or ore, or grow a single crop on any virgin prairie soil.

If, on the other hand, the patrimony that is to be undiminished includes the buildings and other real property that we make from these natural resources, any increase in real property that more than offsets the depletion of natural resources over a generation, means an enlarged patrimony.

Surely something different from either of these must be meant by an undiminished patrimony; but what it is is not easy to state. Basically, our concern is that future generations shall have at least as high a level of living as our own. We could grow in wealth and still defeat such an end. All we would have to do is to convert natural resources into buildings, roads, bridges and land improvements at such a rate, and achieve such a vast inventory of these, that future natural resources will not be sufficient to keep them in repair and replace them as they wear out. We could also in our day-to-day living be eating food, wearing clothes, and burning coal, gas, petroleum and other fuels at such a rate that the natural base of these will not hold out; or the substitutes for some of these, such as alcohol from annual crops, will be more costly than the present supplies. If these are being done, they add up to lower levels of living in the future than now. This surely is the only practical meaning that the undiminished patrimony proposition can have.

The question then is: Have we been doing this? Many conservationists say "Yes." Osborn made a clear statement to this effect at the M.I.T. Mid-Century Celebration; and Raushenbush so implied in his Lake Success presentation These men apparently believe that our rising yields per acre, and increasing output per worker, have come from too free a use of resources of

coal, oil, and metallic ores, thereby arming each worker with more power than will be available in the future, and a freer use of resources of plant nutrients in the soil and commercial fertilizers than will be available in the future.

It will be at once apparent that no conclusive answer to this question is possible. One criterion sometimes advanced is relative rise in prices of food, fuel, lumber, coal, and other materials derived rather directly from natural reserves. But prices are expressions of the relative rates of increase in supply and demand, and could fall merely because of over-rapid exploitation or rise for the opposite reason. Food prices did rise, relatively, from 1870 to 1920, but this was because rates of exploitation and the arts of food production did not keep up with the growth of population and rising levels of per-capita demand for food. Food prices were depressed from 1920 to 1940 because exploitation and the arts advanced the more rapidly. So thinking, Raushenbush at the United Nations Conference predicted fifty years of rising food prices. I made bold in reply to predict no net rise over this period. The basis for my prediction was nothing more than a belief that the arts of agricultural production will advance as fast as the demand for food; and that the present backlog of unused agricultural technology will persist as a result of new discoveries. The natural scientists at the M.I.T. mid-century celebration, Dr. Vanuevar Bush especially, exhibited more extravagant beliefs on this score than I have ever dared.

There is one other contingency that needs to be considered, namely, that surplus farm populations will migrate to cities at an accelerating rate and raise prices of farm products presently to a higher relative level. Colin Clark made much of this in his Lake Success paper, and even called for a de-emphasis on industrialization except in the severely overpopulated rural

countries and areas. (Probably he would put our own South in this group.) It has to be admitted that after making all the adjustments one can for differences in costs of living, farm family incomes have remained too low in all countries because of high rural birthrates and non-compensating rates of migration. If the migration rates rise importantly, as Clark expects it is likely to be because of the replacement of farm labor by power and machinery. The farm workers will be pushed out more than pulled out. A year ago now, the Delta cotton area was making a great bid to get 15,000 more workers to harvest the rest of its cotton before serious danger from the rains. If the machine makers have sold as many cotton pickers in the Delta as they planned to sell this fall, they will have replaced 20,000 hand pickers, allowing 25 per machine. Such substitution, however, lowers prices of farm products at the same time that it augments migration.

* * * * * * *

The third major element in the role of conservation in a good society concerns the conflict between public and private interest in conservation. The professional conservationists have much to say about the failure of competition and free enterprise to give us proper conservation. That the public has interests in preserving natural resources that are in addition to those of individual property holders, no one questions. One has only to mention the public interest in flood control, in protecting reservoirs from siltation, and in the preserving of recreational, scenic and wild life values, to make this point clear. Equally clear is it that the time-span of the public interest is likely to be longer than that of most private property holders. For this reason, governments and their supporting publics have a great obligation to see that the public values in all forms of resource use are fully analyzed, and that the necessary measures are taken to protect these values. There is by no means enough of such analysis at present, and

no doubt some important needs for protection are being neglected -- but in spite of rapidly growing expenditures on such protection.

* * * * * * *

In this connection there needs to be mentioned the fourth factor in our problem, a special type of risk that retards adoption of longer-span management plans -- the risk that the remaining virgin supplies of natural resources will keep the price down to a level that will not compensate one for an investment in a more intensive use of resources. Frequently associated with this is the risk that new technology will increase or cheapen the supply. The timber situation in the United States illustrates the foregoing simply. In spite of all of the very free exploitation of the forests of the United States, the stumpage prices of a large majority of the types and grades of timber in the United States are still kept so low, by timber that grew without benefit of any management, that only very circumspectly dare most timberland owners venture more than simple extensive woodland management practices. Most of our virgin timber areas have been cut over, it is true, but large virgin resources of other species, particularly hardwoods, remain after the first logging, and natural reproduction following cutting has added still more. The major retarding factor in adoption of woodland management practices in this country from the Lakes states east is a sufficient demand for the low-grade timber that needs to be cut out as the first step toward sustained yield management. The Forest Service Reappraisal report estimates the current drain on timberlands at 13.7 billion cubic feet, and the annual growth at 13.4. The large deficit is in sawlog timber.

The discussion of petroleum resources at the Lake Success meeting by Dean Levorsen of the Stanford University School of Mines furnished another exemplification of this risk factor. The recent rise in prices of petroleum

has been due, according to Levorsen, not to any scarcity of resources, but to lag in discovery operations because of the fear that new oil fields will break the market. I quote him exactly:

> "There seems to be ample evidence of the abundance of undiscovered petroleum reserves in the world in terms of the future needs of the world. Any failure of world supply to meet world demand over the next several hundred years will certainly not be due to a lack of undiscovered reserves but rather to a failure of the discovery effort for one reason or another. Experience suggests that failure of discovery is more often the result of failure to provide a healthy political and economic climate than it is a failure of technology. Whatever the cause, the crux of the problem is discovery -- to reduce these undiscovered reserves to possession."

Where risk is a vital factor in the rate of utilization of resources, a further role of public agencies may be indicated. Nations are in much better position to underwrite risks of this type than is private enterprise because of the much broader coverage and base they afford.

* * * * * * *

It follows from our analysis of these four factors in planning for future generations that so far as the United States is concerned, and for at least 40 per cent of the rest of the world, and for more later, the issue is not one of whether or not the human race will perish from lack of resources, or even have to exist on a lower plane of living, than the present; but rather one of how much better we can make future than present living by developing sounder plans for the future use of our resources. This is the real opportunity confronting the youth of this generation.

It is to the conservation problem stated in these terms that the really constructive conservationists are addressing themselves today.

* * * * * * *

When the problem is addressed in these terms, it becomes one, in the case of agricultural lands particularly, not so much of subsidizing the protection of land resources, as of helping the private property holder to

see his own best interest. The procedure for doing this that is coming into wider use each year is called farm planning, or farm-and-home planning. We at Harvard have been assisting in developing this procedure over the past thirteen years, working in close collaboration in this with the University of Massachusetts and several divisions of the United States Department of Agriculture, including the Soil Conservation Service, the Forest Service, and the Bureau of Agricultural Economics.

On the farm plan that I am looking at now, which happens to be for a 204-acre farm in Worcester county, there is first of all, a very real choice as to the use to be given to several of the fields, whether to leave them in their present use, which may be a brushy pasture, or open stony pasture, or poor hay land; or to fence them off and let the trees come in; or to use a bog-harrow on them and lime, fertilize and seed them to some pasture mixture; or to remove the stones and convert them to cropland. The central portion of the farm is a big rounded hill, of the type called a drumlin by the geologists, which has been used in different rotations, some of 4 or 5 years and including silage corn, some much longer and including a year in oat hay for reseeding purposes. Some erosion has occurred when steeper slopes have been used for silage corn. Shall this farm continue to grow corn or shall it rely on grass silage? If the first, strip-cropping will be needed on two of the fields. The whole field layout is subject to wide variation: What stone fences will be removed and what fields consolidated -- and how will the fields lie with respect to the slopes? Then there is considerable choice as to the pasture and hay mixtures to use -- how much to depend on ladino clover, on alfalfa, on brome grass, etc. The yield of any of the crops and the carrying power of the pasture will depend upon the rate and frequency of fertilization.

Of course, basic to all decisions of the foregoing sort are decisions as to the size of the farm business to be maintained on this farm. Involved in this is a decision whether to repair and enlarge the present barn or build a new one. Basic to both of these is a family decision as to whether to develop this farm as the future business and home of the second oldest boy in the family, or merely of the present owner-operator with dependence upon hired labor.

When we first analyzed this farm business in 1938, we presented to the farmer and his family six different combinations as alternatives to his management plan at the time. These would have provided a range of from 37 to 56 cows, from 14 to 22 calves and heifers, from 55 to 82 acres of cropland, 10 to 31 acres of open improved pasture, 140 to 197 tons of silage, 70 to 133 tons of hay, 207,000 to 307,000 pounds of milk annually, labor inputs of 29 to 36 man-months, expenditures ranging from $6,700 to $9,800 per farm, and net returns from $2,150 to $5,025. The farm at the time was keeping 26 cows and 8 heifers and had a net income, figuring expenditures and receipts at the same price level as in the foregoing, of $1,400.

The family chose as its most feasible plan one that the farmer and his boy could handle with one hired man, that called for keeping 37 cows and 14 calves and heifers and using the old barn after some remodelling, and that promised a net return of $2,150.

Upon our return to this farm two years ago, we found that this farm family had the 37 cows and had developed much of the plan chosen in 1938 and that it was now planning to build a new barn and adopt Alternative 5, which calls for 52 cows, 82 acres of cropland and 32 acres of improved pasture. The boy was home from the wars and preparing to take over the farm in due time.

As for the farm woodland, the farm in 1938 had only 8 acres of real woodland, but 126 acres of brushy and wooded pasture. The alternative adopted at that time called for fencing off part of the woodland pasture and improving a small fraction of the brushy pasture. Alternative 5 calls for 26 acres of brush pasture and 63 acres of woodland.

A more recent undertaking has included 239 dairy or dairy-combination farms averaging 225 acres in 14 areas in the six New England states. This project has been financed by the Charles H. Hood Foundation of Somerville, Massachusetts, and carried on in collaboration with the six New England states universities or colleges, and the United States Department of Agriculture. The plans worked out with these dairy farmers promise to increase the net farm incomes by exactly one half. They call, on the average, for only a 2 per cent increase in the acres in crops, and for improving, by fertilization and seeding to better grasses and clovers, and a little clearing away of brush and stones, an additional 17 acres of pasture land per farm and 11 acres of hay land. The average forage production of these farms will be increased from 135 to 192 tons, the number of milk cows from 24 to 31, and the production of milk per cow from 6,700 to 7,400 pounds, with a 5 per cent decrease in purchased grain per cow. An average of 98 acres of woodland per farm put under simple and not very intensive management will double in output, and return 40 per cent more per man-day of labor.

All of these farm plans were worked out in collaborstion with the technicians in the Soil Conservation districts. Nearly all of them were, or presently will be, collaborating farms in these districts. All of them provide adequate conservation at no important sacrifice of income over the next ten years.

It follows from the foregoing that in our planning of farms, more often than not we come to the happy result that the system of land management that

pays an owner-operator best is also one that also accords with the longer-term public interest. It simply does not ordinarily pay a farmer to let the productivity level of his farm fall very far below the optimum level.

A positive form of statement of this same proposition may be more meaningful. Take any farm at random anywhere in the United States and work out for the owner a plan with its operator that promises to maximize its net return over even as short a period as five or ten years, and the chances are at least four out of five that this plan will build up rather than lessen the productivity of the farm.

While the foregoing accurately describes the prevailing situation in the United States, thousands of farms in almost any large block of counties are suffering serious loss of productivity at any given time. A large fraction of these are farms rented under leases that in effect offer inducements to tenants to abuse them. Another large fraction are farms too small, especially if size is measured in net product, to finance needed improvements or additions to capital. Others are farms operated by men too old to make improvements. It is highly important for the country and its people that the losses from all of these sources be checked. It is for this reason that we economists in the United States support vigorously the present conservation programs -- not because we are fearful of world hunger.

In such farm planning from the point of view of the individual farm, the essence of the problem is to determine, in any given economic situation, the combination of practices which will yield the highest net return over the time-span chosen. One cannot, therefore, really determine that any soil management practice is <u>best</u> until he tests it in relation to its effect on net return. Usually there is a wide range of alternative practices, or intensities of application of a given practice, among which a choice must be made according

to which will contribute most to the net return. The combination of all these that meets this test is properly called the optimum and is so referred to in this paper. It may not give the maximum of many things, including preservation of the soil.

The basic principles involved in such planning are simply these, that land can be maintained at different levels of productivity -- some cotton lands of the South, for example, at levels giving yields all the way from 150 to 500 pounds per acre -- and that at any given time, in a given state of a country's demand for food and other products of the soil, it pays a farmer to maintain the soil at a certain level of productivity. If all the cotton land in the United States were maintained at the maximum level, the supply of cotton would depress world cotton prices to 6 or 8 cents a pound. There is a similar most advantageous maintenance level for Corn Belt lands. To exploit or mine them in their virgin state until well down to such a maintenance level has commonly been good national economy. On virgin soils of high natural fertility, such as in the heart of the Corn Belt, this may permit taking more out of the soil than is put back for several decades, but not elsewhere. Except in such areas, the farm that is running down, as a result of heavy cropping and small replacement of plant nutrients, or from excessive erosion, declines in profitability within five to ten years.

Could the productivity of the New England dairy farms be raised still further? Very easily. Then why do not the plans provide for this? Because the market for the milk will absorb a larger volume than planned only at too low prices. The productivity level designed for these farms is the optimum under present economic conditions. Perhaps it needs to be added that this optimum has been rising on the better lands of New England for the past fifty years because the market for fresh milk and other perishable and bulky

products has been enlarging with the growth of cities. A similar analysis in most parts of the United States would show closely parallel results. Nearly everywhere the limit on improved management would be set by the market for the farm products.

On those farms in which the optimum for the private owner is not the optimum for society, the one out of five conjectured above, the public needs to make up the difference. There are several ways of doing this. One is to make loans available at subsidized rates of interest. Another is to make direct conservation payments, such as the so-called ACP payments under the present AAA program. Time does not permit an evaluation of these.

On the four farms in five where the public and private interests run closely together, the subsidy needed consists solely of an expanded program of aid in farm-and-home planning. These plans, however, must include financing also, that is, provision for loans and repayments to cover the cost of the land and building improvements called for. The 239 New England dairy farm plans call for an average additional investment of $480 in land improvements, $1500 in buildings, $970 in equipment, and $1360 in livestock. The livestock can about all be grown on the farms. But $3000 will have to be borrowed. Local banks should be able to provide most but not all of this. Some public loans will be necessary, because the terms and the risks are not in keeping with the requirements of ordinary commercial banking. Public credit can have a much wider risk base.

The plans for these 239 farms included the woodlands along with the dairy farming. Much of the woodlands work can be fitted in with the other farm work particularly because it can be done at slack seasons. The returns from this work projected on these farm plans average $5 per day in the first 5 to 10 years, and $7 per day in 40 to 80 years.

Around three-fourths of New England is in forest. Around half of the three-fourths that is in forest is in holdings of less than 5,000 acres, and 165,000 of the 244,000 small holdings so defined are outside of farms. The average size of these non-farm holdings is 80 acres. The management of these, according to the recent Reappraisal Report of the Forest Service is dominantly "poor or destructive"; that of 40 per cent is rated as "fair", and of only 6 per cent "good."

This situation is not peculiar to New England. Woodland ownership patterns like New England's are found pretty well over the whole Northeast, the Lake States, and other large areas. The Forest Service in all its public statements stresses the high necessity of developing successful methods of management of these small non-farm holdings.

Managing these small non-farm holdings obviously presents a difficult undertaking. The owners of a large majority of them are not in a position to combine work on their woodlands with farm work or other occupations -- any labor at weeding, thinning or other improvements must be hired, and the owner and his timberland may be widely separated.

The practical problem confronting those who would like to see better management on these small holdings is to devise systems that will cover the additional costs involved and yield a better return. It is not likely that highly intensive management will pay for itself on most of the timberland in these holdings. The level of intensity that will pay best will vary greatly with present condition, species, forest site, distance to market, type of outlet, and wages of labor. The management problem therefore requires an intimate combination of economics and technology.

We at Harvard University are at present engaged in developing a project whose purpose is to develop plans for the management of those small non-farm

holdings that will wherever possible pay out under private management. Several different management plans will be tested out and adapted to different situations and types of timber stands. We know before we start that the owners of such woodlands must think in terms of a much longer time-span than the owners of farm lands, and that a majority of the ordinary rank-and-file of such owners will not be in position to make the investments needed now and wait for their returns. Nevertheless, it is important to develop plans for those who are in position to wait; and for the rest to discover how much and what forms of subsidies are necessary to assure protection of the public interest.

Large timber owners, especially those combining processing with woodland management, will more generally be in a position to practice good management.

These three land use planning projects under way in New England do not stand out in lonely grandeur. They fit in and complement a far-flung program of planning agriculture and other land use not being undertaken by a wide range of public agencies. Following is a list of these with a brief statement concerning their methods and procedures.

1. The Soil Conservation Service (SCS), which makes conservation plans directed toward keeping the water on the land and the soil in place, with such attention to pasture and woodland management, rotation systems, and the like, as is pertinent thereto. These plans are complete in the sense of including all the land within one farm boundary, but not complete in the sense of including economic analysis along with the physical and biological. Some planning is done for districts as a whole.

2. The Production Marketing Administration (PMA), called the AAA before the war, which makes payments to farmers for following certain conservation

practices designed to maintain the productivity of the soil, prevent erosion and the like. Keeping the land in "soil-building" and "soil-maintaining" uses as against "soil-depleting" uses is a basic feature of this program. Simple maps of the farms and simple farm plans are used as a basis for these practices, but there is little in the way of economic analysis. A program is under way of improving the planning in selecting "experimental counties."

3. The Farmers' Home Administration (FHA), which makes very careful plans based upon economic as well as conservation analysis for the small number of farms included in what was formerly known as the Tenant Purchase Program. This purchase program now includes a certain amount of financing of the purchase of additional land to make small farms into economic units. At one time this program included an extensive program of loans to low-income farmers to enable them to increase their incomes, these loans being based upon farm-and-home plans that included economic analysis as well as planning for conservation, but the case load was so large that the plans had to be hastily done.

4. The Tennessee Valley Authority (TVA), which has made plans of a sort since the beginning of its "unit-test-demonstration" program. At the start these did not include planning the livestock enterprise of the farm. They are now more nearly complete plans. This program is limited very largely to the Tennessee Valley parts of the seven so-called Tennessee Valley states.

5. The Agricultural Extension Service, which is doing an increasing amount of farm-and-home planning. There is no uniform pattern for this planning. In Missouri it takes a form of helping individual farmers and groups of farms to work out their own plans so far as possible under what is called the "balanced farming" program. Several of the states are beginning to follow Missouri's lead; and in other states this planning takes the form of having farmers make use of a record and farm planning booklet with instructions as to planning procedures.

It will be obvious from the foregoing that there is great need for integrating the work of these different agencies. In the reorganization plan for the Department of Agriculture worked out by the Hoover Commission, specific suggestions are made for this integration. These are likely to meet with very great opposition from the agencies involved. The Soil Conservation Service, for example, is not desirous of integrating its work with either the Production Marketing Administration or the Agricultural Extension Service, and the Tennessee Valley Authority wishes to keep the Soil Conservation Service out of the Tennessee Valley counties.

This integration needs to include all the land in area units, not just the agricultural land. The Worcester County study described earlier is an undertaking of this sort. The plans provide for what is determined to be the most advantageous use of all the land in all the towns in the county. This use is planned in terms of management units, which are individual farms in part, but also non-farm woodland holdings in large measure. The management unit suggested for some of these woodland holdings involves public ownership by local or state governmental units.

In this planning of land use in Worcester County, all of the agencies listed above participated. The Soil Conservation Service mapped the soils and vegetative cover and slopes, condition of erosion and other pertinent facts. The Forest Service assisted with the mapping and classifying of the timberland and mapped it out in forest sites. The Bureau of Agricultural Economics assisted with the economic and sociological analysis. The supervision and field work and the detailed analysis was about equally divided between the University of Massachusetts, the Harvard Forest, and the Graduate School of Public Administration of Harvard University. Similar collaboration has been worked out in the dairy farming project. No

difficulties have arisen in the way of effective collaboration among these agencies.

* * * * * * *

I hope that these illustrations of actual conservation planning in agricultural forestry and land use in general have given you an insight into its true nature. The conservation alarmists have a useful role, but the important need is for men who can grapple with the realities of the problem of management of our resources so as to get a fuller living out of them by future generations.

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37th ANNUAL MEETING

Chamber of Commerce of the United States

Washington, D. C. - May 4, 1949

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* * *

INTRODUCTION

By

RALPH CARR, Chairman

RALPH CARR, lawyer, former Governor of Colorado, is a director of the Chamber of the United States, a member of the Chamber's Natural Resources Department Committee, and chairman of its subcommittee on Forestry and Public Lands. He is an authority in the field of water resource problems of the Western States and champion of the rights of the states against federal encroachment.

T IS MY PLEASURE to welcome you to this ound table that has been developed under he auspices of the Natural Resources Deartment and the Agricultural Department f the Chamber of Commerce of the United tates. We have the temerity to start ith the bold assertion that our renewable esources can be sustained.

he Chamber believes that only on such a asis can we maintain the firm economy hich characterizes America. We believe hat our renewable resources can furnish he means by which our population can ave continual access to the high standrds of living in which we take such ride. Without them our efforts toward onstructive world leadership will vanish, s will the social integrity which we asociate with the democratic form of govnment. Our ability to sustain them s more than an assertion; it is a chalnge.

IAT ARE RENEWABLE RESOURCES?

ou may well ask, "What do we include thin the term 'renewable resources'?" ey are those natural resources which are pable of being renewed by man's efforts d which, for the most part, are capable of being renewed during the life time of an ordinary man. They include the soils from which all life springs; the waters which make life possible; and the forests which, like other crops, are dependent upon soil and water.

No discussion of these renewable resources is complete without consideration of the end for which they are renewed and sustained, a strong and virile population.

Perhaps now, as never before in the history of man, we are confronted with the age-old comparison between increase in population and production of food.

THE MALTHUSIAN THREAT

This was spotlighted 150 years ago by Thomas Robert Malthus, an English economist, whose writings gave rise to such assertions as "Population increases in geometrical ratio, while food increases in arithmetical ratio." No one has ever proved this. On the contrary, there is strong reason to believe that application of science and modern technology has postponed, if not actually erased, the old Malthusian threat of poverty

and starvation. Nevertheless, statements credited to him are so often repeated that people accept them without argument.

At times the ghost of Malthus assumes such terrifying proportions as to overcloud the heavens and threaten the world with ruin. In spite of such statements and fears, however, we humans proceed with more faith than knowledge. Science has already given us so much knowledge that most of us know more than we apply in practical living.

THE GOAL

Our goal is greater than the production of food, the saving of soil, the growth of forests, or the development of power. Important as they are, we must not lose sight of the necessity of providing an economic climate and a social atmosphere suitable to the development of human character, the encouragement of private initiative, and the development of industry. They are each dependent, one upon the other. Together, they make a strong nation.

At the invitation of the Chamber, this subject will be opened by four men whose thoughts and actions in terms of sustaining our renewable resources have given them national recognition; I might even say world recognition. They are here to present their ideas and to defend them, if necessary. Each will speak for ten or twelve minutes. Thereafter, the proposition will be open for discussion among themselves and from the audience.

Before we start our more or less formal program, however, I want to introduce one of the guests who is here and to extend to him an invitation to say a few words.

I am according this special privilege to Cornelius Vanderbilt Whitney, Under Secretary of Commerce. Mr. Whitney is a forest owner, whose northern New York properties have been under scientific management for more than 50 years. Under his direction the lumber and forest-products activities of the United States Department of Commerce promise to have sympathetic and intelligent guidance. Mr. Whitney!

GREETINGS FROM THE SECRETARY OF COMMERCE

THE HONORABLE CORNELIUS VANDERBILT WHITNEY: First of all, I bring to you the greetings of the Secretary of Commerce, Mr. Sawyer, who was unable to attend this important meeting and asked me, on behalf of himself and the Department, to represent him and say a few words.

THE WHITNEY FOREST

As the Chairman mentioned, I have been interested myself, and my family, in this subject for a long time. My grandfather, Mr. William C. Whitney, was in the government of his country, was Secretary of the Navy under President Cleveland. One of his principal side interests was timber. He put together a large property in northern New York State, and the textbooks of New York State dealing with forest practices which were used in the public schools were the textbooks created by my grandfather.

When I started managing that lumbering interest, I looked up his old principles to see what they knew at that time. I found the old reports made for him at that time on his forests. I then set about finding whether the things he had hoped for had come true. His experts at that time had told him how to cut a forest and, in the end of their recommendations, they said, "If you will follow these practices, within 40 to 50 years you will have an equivalent forest to cut again."

I made a survey of that forest as one of the first things I did, and the estimates came out to be one-third of the original stand. I am sure Mr. Weyerhaeuser here, who is an expert on lumber, will be interested in those statistics.

I do not know whether that is similar to other tracts which were cut at that time but, at any rate, the experts of that period, as far as I can see, made a very great miscalculation. I hope that our experts today are going to do better.

HORSE SENSE

My own personal interest in conservation, outside of forestry, took the form of farming. Strangely enough, it came about through horse-racing. Probably some of you here know that my family and I have owned a stable of race horses which has had quite a good deal of success throughout the years, for many years. About ten years ago or more, my racing stable began to deteriorate, having stood first and second in the country and having operated one of the outstanding stock producing farms in this country. I was busy with other things and did not pay much attention. I woke up one day to find that I had slipped from the top of the heap to close to the bottom.

Many suggestions were made to me as to what to do about it. I may say that I took none of them. Instead, I proceeded to apply good farming practices on the farm upon which the horses were being reared. With astounding rapidity the Whitney horses regained their former position.

Since that time, I have come into the federal government. The Department of Commerce, which I now represent, has a great interest and stake in natural resources and their conservation. The business economy, commerce itself, depends on what is produced from the earth.

OUR CONSERVATION PROBLEM

The problem before this gathering today, as I understand it, is how do we implement the President's desire to have us prepare legislation and programs to utilize our natural resources to their maximum without unnecessary depletion and, in some cases, with actual improvement? I have a suggestion to make on behalf of the Department at this time. Perhaps these gentlemen will want to discuss it in their deliberations this afternoon. It is premised on this fact, that we believe the economic well-being of our country and our national security is dependent upon the efficient use of our natural resources, and the efficient use of these resources will go far to preserve our productive capacity, full employment, and high economic level.

The Department of Commerce recognizes it is timely that we should seriously attempt to develop and apply a comprehensive timber conservation program, a program consistent with national policy and our national economic needs. Such a program should take into consideration the need for full employment and full production, consistent with our available resources.

FOREST CONSERVATION COMMITTEE

In order to achieve the objective, government agencies, representative organizations and industries concerned with the problems of growing timber and timber utilization, should be invited to take part in the program. I therefore present for your consideration this thought, that a forest conservation committee be appointed and a chairman selected who is an outstanding figure in this field, and that this committee be charged with the responsibility of recommending a realistic program to be applied to maintaining and improving our present timber standards.

This suggestion must in no way be interpreted to mean that we are advocating private encroachment on public lands or public encroachment on private lands.

I assure you that I would personally be glad to assist in the development of such a program.

CHAIRMAN CARR: Thank you Mr. Whitney. We appreciate every suggestion you have made.

MODERN ECONOMY'S THREAT TO OUR RESOURCES

By

FAIRFIELD OSBORN

FAIRFIELD OSBORN, naturalist and author, is president of the New York Zoological Society, president of The Conservation Foundation, editor of THE PACIFIC WORLD (1944), and author of OUR PLUNDERED PLANET (1948). He is a member of the executive committee and advisory board of the American Committee for International Wild Life Protection, member International Committee for Bird Preservation, Fellow of the New York Academy of Sciences, and member of Council of Save-the-Redwoods League. He has traveled widely in this country and abroad.

IT IS A HIGHLY IMPORTANT development that this national institution is using this occasion to focus attention upon this pressing question of renewable resources. We are all recognizing more and more that they are the primary factors in the economic wellbeing of our country. The results of your considerations can be far-reaching, assuming this discussion, and others like it, lead to action — and soon.

Apparently you have assigned to me, by nature an optimist, the unpleasant task of summarizing some of our failures and shortcomings. Fortunately, there are two sides to the picture. I will give the dark side first and conclude by referring to those things that are truly hopeful and of great promise.

THE DARK SIDE

Ever since President Zachary Taylor was in the White House, just a hundred years ago, we as a nation have prodigally used and spent these life-supporting resources with little if any thought for the future. Our national economy has been anything but good economy because we are breaking the primary rule of all business, namely, living to a great degree upon our capital account in that we have been steadily drawing upon our reserves. To this degree, our famed high standard of living is neither a true one nor a permanent one.

Obviously, our nation cannot continue to do this much longer. Already we can sense oncoming scarcities — for example, in water resources and in lumber. These make it obvious, even to the casual observer, that the day of "reorganization" is at hand.

The problem of population pressures in other parts of the world is well known. We are inclined to disregard some of the implications of the rate of population growth in our own country. I might recall that in President Taylor's days our population was about 23 millions; in 1900 it was 75 millions, and has since almost doubled. It is likely that we will have at least 10 millions more people in the next 11 years, indicating more customers but also an increased demand upon our water sources, fibres and

food supplies. Any national conservation program will obviously need to anticipate this additional demand. At the same time the curve of our standard of living is still working upwards, in itself an additional drain upon our resources.

THE PROBLEM DEFINED

Our discussion today is not focused on inorganic natural resources such as minerals and oils, which is another though a related subject. The renewable resources, namely, the products of the land, whether lumber, crops or animals — each dependent upon productive soils and adequate water resources — are those upon which not only our national economy but the actual subsistence of each person is primarily dependent. If wisely used, they can always be available to us.

About one-half of American industry today — whether stated in terms of plants or jobs or output — relies directly on these renewable resources for its principal raw materials; over one-third of the nation's power is hydroelectric; about one-fifth of the industrial kilowatt hours are devoted to processing organic resource material; nearly one-fifth of the revenue freight of the nation's railroads derives from the carriage of these raw materials alone. The future of our country's wellbeing depends upon our getting on a sustained-yield basis. This is now evident to all of us. Every element in the life or our nation has got to get into this game of Conservation.

SQUANDERED FORESTS

Now, let's take a quick summary review of some of our errors and abuses. As to forests, we have in the last 40 years reduced our reserves of saw timber by more than 40%. Today our annual consumption of this, the biggest drain upon our forests, exceeds annual growth by more than one-half. At the present rate of drain, assuming there are no other changing factors, we will not have a stick of saw timber left in this country in another 87 years.

A great deal of this loss is preventable. For example, it is estimated that of the total wood-drain in our country 35% is being lost by wastage.

This points up the unpalatable fact that waste has been a national characteristic since the days when 40 million buffalo were slaughtered for their hides and innumerable carcasses were left to rot on the plains. Oh, the romantic glories of prodigality!

Granted that saw timber is only one element in our forest needs, this is obviously a drain that must be corrected. Within the last 16 years the general commodities index has risen about 100%. In the same period the price of lumber has risen more than 250%, a direct reflection in prices of what has been taking place.

RUINED SOILS

Of our billion acres of rangelands, farm pasturelands and croplands we have ruined or severely impoverished approximately one-quarter by misuse. Such losses are totally preventable. Paradoxically, by extra-ordinary advancement in agriculture techniques we have substancially stepped up crop production both in the aggregate as well as in the average per acre. This fact appears to discredit those individuals such as myself who take the position that our conservation practices do not as yet begin to be adequate. Quantity production, unless soil productivity is preserved, is good for today, but fatal for tomorro

In a statement made last December, Robert M. Salter, Chief, Bureau of Plant Industry, Soils and Agricultural Engineering, observed: "Improved technology cannot, in my opinion, continue to carry the load. The simple fact is, of course, that there are too many acres of

corn in the corn belt relative to the acres of soil building sod legumes....One just can't expect to keep up the soil's productivity under such a system." In these observations no reference is being made to soil erosion, with the threat of which I believe we all here are familiar. As yet not more than 15% of our croplands are being worked on proper land-use methods.

WATER SUPPLY

In regard to water supply, we all recognize that this is already a critical problem in a number of regions, both for communities and for industries. Water tables, representing underground resources, are dropping in many different parts of the country. As you are well aware, vegetative cover, including forests, is an essential to our water resources, which points up the fact that the conservation problem involves the recognition of the inter-relationship of all of our renewable resources rather than dealing with any one of them piecemeal. It is easy to prophesy that water shortages, already a serious problem here and there, are going to become increasingly headline news.

WILDLIFE

Just a word as to wildlife. We still think of it as game animals, water fowl and fishes at the far end of a rifle, a shot-gun or a fishing line. We are apt to forget that animal life, from protozoa to mammals, is an integral element in the entire economy of nature.

THE BRIGHT SIDE

What's on the bright side of the picture? A great deal. First and foremost, we are waking up as a nation to the situation we are discussing today. There is nothing in this country that we cannot accomplish if public opinion really become sufficiently aroused. Further, wonderful advances have been made in methods of agriculture. Science triumphant in the physical areas is exploring methods of supplementing the biological processes of nature. It must do so. The situation calls for scientific exploration even into uncharted channels from which new sources of organic material can be drawn — sources of either land or marine origin.

The net of the situation today is that we have the "know how." In turn, there is ample evidence that the renewable-resource problem can be solved in this country. We have only to follow the pattern of what is already being accomplished in certain agricultural regions or take a leaf, on a nationwide basis, from the book of some of the great lumber companies, who are successfully getting their forest reserves on a sustained-yield basis. In this regard, however, 75% of all privately owned forest lands is in the hands of 4,200,000 owners, with an average size of holdings of only 62 acres. The introduction of proper forestry methods on these holdings is essential.

COOPERATION NEEDED

I am to be followed by speakers of the highest competence in these matters. In hearing them you will realize that we have the technical "know-how" as well as an enlightened point of view of the responsibilities of ownership. In listening to them, however, please let me point this out. It is not that we do not have the skills; it is not that we do not have many examples of responsible ownership. The question is the extent to which sound conservation practices can be adopted throughout our entire country and how soon we can reach this great objective.

Isolated leaders, whether in skills or in trusteeship, are impotent unless they are supported and followed by public opinion and by the army of our citizenship in government, in organized labor, business and industry, and in education, who too

are prepared to serve. In other words, unless business and industry, organized labor and all other elements in our nation become aware and are prepared to act, we shall not have resolved this problem, which beyond all others, lies at the core of the future wellbeing of our country.

PROSPECTS OF SOIL SCIENCE

By

CHARLES E. KELLOGG

CHARLES E. KELLOGG, soil scientist, is Chief of the Soil Survey of the U. S. Department of Agriculture. He is a native of Michigan with a Doctor of Philosophy from Michigan State College. His foreign travel includes assignments to Russia, New Zealand, North Africa, the Belgian Congo, England, Germany, Italy, and Mexico. His writings include THE SOILS THAT SUPPORT US, as well as bulletins and magazine articles.

FIRST OF ALL, Mr. Chairman, it isn't often that a country boy like me gets a chance to discuss his problems with such a group of distinguished business leaders. So I shall try to make the most of it. I shall not take time to tell you how bad the situation is; it is bad enough without all the current exaggerations. Nor shall I try to explain what won't work, or analyze programs that can only be carried out in a dictatorship.

NO SINGLE SOLUTION

The highly emotional writing and talking about the problem of soil resources — the so-called "diminishing" soil resources — may do some good. People do need to think about the agricultural problem in the world —about soil, and food, and people. All of us do. Yet, screaming can do a lot of harm. People may seek some single, revolutionary answer. And there isn't one. Or, worse still, people might be scared into some kind of dictatorial program.

We know there is overcrowding on the land in several countries. Populations are increasing faster than the food supply, especially in places where skill in medicine has gotten ahead of skill in agriculture and industry. I recognize that there has been, and is now, unnecessary soil depletion through erosion, through loss of organic matter, through destruction of soil structure, and especially through declining soil fertility. This overcrowding and this soil depletion hurts me as much as it could possibly hurt anyone.

But I don't agree with the extreme statements. We are not facing any calamity because of soil depletion. Erosion has been played up for 23 years. It is no more important than several other soil management factors. Generally, erosion is a symptom, not a cause, of declining fertility and bad management. We must get back of these symptoms. In my judgment, if the current exaggerations of this one factor were acted upon seriously and literally, our agricultural programs would become so distorted that we should fail to meet our food requirements, and we should even worsen the symptom itself.

Nor must we tear up our democratic institutions to apply science to food and agriculture. In fact, under dictatorial schemes, the very wells of science dry up.

SOILS ARE MADE

Then too, one could scarcely over-emphasize the great differences among our soils — differences they had in the first place. Thousands and thousands of soil types exist in the world. A few of these are naturally productive for food crops. They give a good harvest when first cultivated. Most soils do not. The farmer literally makes his arable soil from the natural soil. Think for a moment of the native tree cover of eastern United States, of western Europe, or of the great tropical rain-forests. How unlike these plants are to those man has selected and bred for his own use! Their soil needs are very different. Thus, most good farms in these forested regions have been made good through the use of lime and chemical fertilizers, and especially through the introduction of meadows and pastures with livestock.

NEED FOR SUSTAINED PRODUCTION

To conserve the soil, simply in the sense of "holding" our own, would spell disaster. But we are not concerned with this in agriculture. The balance we are seeking is not a "natural" balance. To achieve such a natural balance would mean suicide for the majority of the world's population, and the life of cavemen for the rest of it.

The level of soil productivity and of farm production that we are seeking will not be based on any "natural" balance. Nor will it be based on history — not on the pattern of techniques we knew in the last generation. What we are seeking is that level of production on a sustained basis made possible by modern science and technology in a peaceful world with reasonably full employment.

WE HAVE THE LAND

What are the prospects? First of all, have we the land? We do. Around $2\frac{1}{2}$ billion acres in the world that is being farmed and $1\frac{1}{4}$ to $1\frac{1}{2}$ that is not being farmed now. Likely we could increase our acreage here in the United States by nearly 20 per cent if necessary — say to something like 450 million acres. This $1\frac{1}{4}$ billion cannot be settled easily. A lot of it is in the tropics. Much of it is far from good harbors or other transportation. Most of it will need clearing and careful management from the start.

AGRICULTURE NEEDS INDUSTRY

Most of all, its development depends upon a parallel development of industry within the same region. Farmers shall need transportation, electric power, medical facilities, fertilizers, machinery, and all the other essentials for modern farming supplied by industry. And largely, the industry must develop within the same country. A little can be done by trade, enough for a start perhaps, but mainly these things must be made within the country. Wherever agriculture is highly developed in the tropics, for example, the community is tied to an industrial area in a customs union, like Hawaii is tied to the United States or Java to Holland before the war.

But do we really need all the land? We don't, if we could and would really put our present technical knowledge into use. Here in the United States, where agriculture is already reasonably efficient— at least one-third of it is — production could be very easily raised 30 per cent on some items and 20 per cent on others, if farmers generally followed the practices now regularly used by hundreds of thousands of good farmers. Thus, millions of our own farmers are not using the machinery, the fertilizers, the lime, the insecticides, the electric power, the good seeds, and so on — materials that industry is furnishing hundreds of thousands of other farmers.

WORLD SITUATION

The opportunities for increased production, and for increased efficiency of production, in many other countries are even greater. My professional associates in the United Kingdom would place the figure at 50 per cent in their country. Probably it is really closer to 50 per cent in our own country than to 20 or 30 per cent. I am sure it is not less than 20 or 30 per cent in the Soviet Union, at least in the sample areas I have seen. In India, there is good evidence that increases far above 20 per cent are entirely possible on the basis of experiments conducted in that country.

Thus, it would be physically and biologically possible to meet the food needs of the world on the land now cultivated, through the use of agricultural systems, adapted to the thousands of kinds of soil, that are already being practiced by good farmers on those soils. With these increases, and with the new land, we could far exceed the needs for 1960.

ACCELERATING PRODUCTION

In strictly physical and biological terms, these estimates are low. They take no account of entirely new technology; yet efficiency of farm production is increasing, right now, at an accelerated rate. Yet such estimates are over-optimistic in terms of the real social, economic, and political situation. The people of the world don't feed out of a common larder. Nor can they. For the most part, each country shall need to improve its own production, balance its own economy. Something can be done through trade, and especially through technological exchanges like President Truman has suggested.

How can we meet the educational problem among hundreds of millions of people who can't read? How can we get the farms into large enough units so the farm family has a real chance to apply technical methods? Above all, how can we get the industry established in eastern Europe, in India, in China, in Indonesia, in Africa, and in all the other places, so the farmers may have the tools of modern technology, and so that the extra people on the land may have an opportunity?

THE KEY IS INDUSTRIAL DEVELOPMENT

If one may say that there is a single "key" to a situation where a hundred things are necessary — if one can be picked out — it would certainly be this matter of industrial development. Agricultural people in these crowded areas are caught in a vicious dilemma. Their farms are small and often cut up into numerous little separate tracts that they must work inefficiently with crude implements. They need big families to have enough hands. But that makes the situation still worse. This is often called a vicious circle; it might be called a double opportunity. With industry to employ these extra people, there would be more room on the land; farms could be enlarged; the products of the industry would be available for efficient farm production. With improved living standards, with something to look forward to, people plan their lives, marry later, have less children, and live longer. How can the change be started? This is the key question — this and all that is involved with it.

Although it cannot be started everywhere at once, great opportunities exist for combined resource development — for the use of soils, forests, power, minerals, and industry together. Near the headwaters of the Congo River, for example, such a combined enterprise is developing most successfully — the Union Miniere du Haut Katanga. It is a large enterprise. It includes many activities. It is a mixed corporation with both private capital and government investment.

Is this one of the ways out for the new and backward areas? Certainly there are

limits to development in new and backward countries by purely private capital. Private corporations tend to specialize in one or two products. They are inclined to take a large volume of profits out of the countries — profits that could be used for initiating additional industries to round out the economy. Then there is always the danger of the rules being changed by the local government — rules affecting taxes, labor, trade, and so on. Of course, I am merely a layman in such matters. But would it be possible to have mixed corporations capitalized by the savings of private citizens of two countries and by investments of two governments? Such a corporation could be licensed under a treaty between the two governments, under which management would not be subject to the threat of capricious changes in rules and under which governments would not be afraid of undue economic power in wholly private hands.

I throw this suggestion out to this group because you are the kind of people who understand such matters. We, in agriculture, can do a lot within our own country and in technical advice to other countries, but this is an age of science. Farmers must have the products of industry to do their job. We, in agriculture. shall be stymied without parallel industrial development. Together we must somehow handle this problem. I am convinced that we have both the labor and the resources.

It will do no good to scream and tear our hair about the overcrowding, about the low yields, and about soil depletion. These problems are manageable, if we could somehow get our economic and institutional problems solved. A great body like this could make a wonderful contribution to the peace and abundance of the world, by constructive thinking along the line of how to develop industry where we have both the agricultural and industrial resources that can only be developed together. The program must be fair to governments, fair to investors, and fair to the people. It must be democratic. Local people must take a part in it. They must influence decisions. Without such an approach, I see no immediate prospect for large-scale improvement. With it, the problem can be met.

A FARMER FACES THE PROBLEM

By

LOUIS BROMFIELD

LOUIS BROMFIELD, author and farmer, is a director of the Chamber of Commerce of the United States, and member of the Chamber's Agricultural Department Committee. Native of Ohio, he has degrees from Columbia University, Marshall College, and Ohio Northern University. He was awarded the Croix de Guerre for American Ambulance service attached to the French Army in World War I, and the Legion of Honor in 1949. His writings include PLEASANT VALLEY, many other books and articles on music, economics, agriculture, and international politics. His farm management activities now extend from Malabar Farm in Ohio to farm properties in the South.

I AM NEITHER a neo-Malthusian nor an anti-Malthusian. Malthus was pretty sound in his day, I think, and is still pretty sound in a lot of things, but all sorts of factors have entered into the picture, since Malthus lived in the eighteenth century, which have upset his calculations, both optimistic and pessimistic. It is a mixed subject — I think, too mixed for any of us to find the final or even a comprehensive answer.

TOO PRODIGAL

I would be the last to deny that this nation has destroyed its natural resources more rapidly than any nation in the history of the world at any time. We came here from Europe, into the richest area of its size in natural resources and real wealth which existed on the face of the earth and, for a period of 200 years, we have done our best to destroy, exploit, and use up all of these things. Soil, water, and forests are certainly on the bottom of the list in relation to our treatment of them.

I would like to emphasize, also, what was implied earlier, that the three are inseparable; soil, water, and forests are all renewable and you cannot separate one from another. Take off the forests, run down your agriculture, and the water goes with it.

THE WATER PROBLEM

I would also like to add that water is not a problem of the West alone, as we all know in Ohio. The water level has dropped between 45 and 50 feet, on the average, within the last generation, and in western Ohio there are towns which cannot bring in one more family, because they have no more water.

In the last century perhaps 75 per cent of our water, in the case of heavy waterfall, has run down to the sea carrying millions of tons of rich topsoil with it, instead of seeping into the earth to replenish our waning water resources. I am glad to say that in Ohio we are beginning to get agriculture so good and so sound

that we will keep, as many farms today keep, as much or more water than the original forests retained on that same land. It will, however, be taking us 50 to 75 years to begin to get the real effect of that soil and water conservation in our own State.

POOR AGRICULTURE BEING SUBSIDIZED

I do not think many of you realize how much these things cost you in dollars, taxes, and so on. All of you are paying high prices for food and, at the same time, you are paying for parities, subsidies, supports, floors, and all the rest of it, simply because we have in this country a very poor agriculture.

I would agree with Dr. Kellogg in saying that perhaps a third of our farmers are pretty good farmers. I would say that we have 10 per cent of our farmers who are good; 30 per cent are pretty good; and the other 60 per cent produce very little more than they consume. Those are the boys who are on the necks of the taxpayers and contribute to high prices for the consumer.

AGRICULTURE AND INDUSTRY

I think myself it would be possible in this country, from a standpoint of sound agriculture, for agriculture to stand on its own feet economically, on a basis of production per acre, per man hour, per dollar invested, exactly as industry has done for 100 years or more. It is not doing that, and we have to support it; we have to support agriculture because, in turn, in supporting agriculture, we are supporting all of you in industry, banking, and other fields. If the purchase power of agriculture declines so does all the rest of our national economy.

In the long period of prodigious industrial growth and, in the remarkable record made by industry, most businessmen have forgotten about agriculture. They have forgotten 50 per cent or more of our population derives its income, wages, and purchasing power from agriculture -- I will not go into that; you can ask me a question about it later, if you do not believe it-- only about 20% are actually engaged in agriculture, but 50% and more of our population depends for its employment and purchasing power upon the services, processing and merchandising based entirely on agriculture. Therefore, the value of a good and prosperous agriculture is of immense importance to the whole of our economy.

The immense structure resting on agriculture and agricultural wealth is so great that, if you permit the base to crack all of your economy will collapse. If you think that does not happen, go back and study the depressions ever since the Civil War and see where they began. They began when the farmer could not go to town and buy a horse and buggy or bag of fertilizer. That meant people were out of work in Detroit, Cleveland, Chicago, and elsewhere. They in turn lost their ability to buy and threw others out of work. And so the disaster pyramided in each depression.

GOVERNMENT INTERVENTION

Probably nobody in this room is more against centralized government and governmental intervention than I am; but let me say that I am convinced that you get those things only when you ask for them. When we got them in agriculture and forestry and water controls, we got them because we asked for them.

In the case of these renewable resources the story is always the same; we go ahead wasting them until the problem becomes too great to be solved by any individual, by private enterprise, or by private capital. That is exactly what you have seen throughout the whole field of agriculture and forestry and elsewhere. Whatever regulations we have imposed through government have been imposed through grim necessity. If we had not set so black a record, they would have been unnecessary.

PEOPLE REFLECT THE LAND

Moreover, in the wasting of those things, we produce very poor people within the wasted areas. As time goes on, with low economic standards, poor diet, and other things, those people become incapable of helping themselves. We have large areas like that in the United States, where if you merely pour in money and depend upon private initiative, you will get nowhere. We are forced to go into those areas and do something about it, because economically and sociologically the people are unable to help themselves. I like it less than anybody in the room, but we asked for it, and that is what we have gotten.

AGRICULTURAL KNOWLEDGE JUST BEGINNING

On the optimistic side, I think it is conservative to say -- and I think Dr. Kellogg would agree with me -- that we have learned more about agriculture and the soil in the last generation than in the whole history of the world. I think, too, we only know about 5 per cent of what there is to know. We are finding out more and more every day. These things are developing so rapidly that it is impossible for any man or group of men to keep up with them.

MALABAR FARM

I work a farm of 1000 acres in Ohio. It is a practical farm, on which no operation has ever taken place in the buildings or in the fields which any farmer could not afford to do, -- even a farmer on a tenant purchase loan. It is entirely a practical farm; we stick very closely to that rule.

We have raised production on that farm in some cases as much as 400 or 500 per cent, and even better than that. It has not been a question of spending money, and it need not be, in most cases, beyond the limits of reason. It is a question of using the knowledge we have available today from Dr. Kellogg, from Dr. Bennett, and others in our governmental service, in our state colleges, and from that great fund of information and knowledge which comes from the good dirt farmers themselves. Their contribution has been immense all along the line.

SOIL EROSION A SYMPTOM

I would like to emphasize one point of Dr. Kellogg's, that perhaps there has been too much emphasis on soil erosion and upon soil conservation in the technical, or what we might call "engineering" sense. He pointed out very truthfully that soil erosion is a symptom and a result, and not a cause. It is a symptom and a result of bad farming. If good farming practices become general, erosion will correct itself.

However, the erosion problem has become so serious in this country and so destructive that we have had to go at it the other way around. We had to take what you might call emergency measures, the building of terraces, strip cropping, all sorts of purely engineering devices to stop it, in order that we may establish a good agriculture. A good agriculture would never have led us to this same erosion.

So I run into cases in parts of the country where a farmer has heard so much about stopping erosion and about soil conditions that he thinks all that is necessary is to put in a terrace or to contour-plow.

Of course, that is not true. If he goes on depending on that belief, his farm, his yield, his organic material, the capacity of his land to absorb water and check water and stop flooding, stop erosion, stop siltation of all of our great reservoirs, the whole capacity of the soil to produce, goes downhill. All this happens unless he is a good farmer.

The purely mechanical aspect of correcting soil erosion is not the answer. That is purely a temporary, emergency step upon which you build a sound agriculture. Again I think Dr. Kellogg would agree.

NO "WORN-OUT" SOILS

I do not believe, incidentally, in what is called a worn-out soil, nor do I think any good farmer in the United States believes in it. The very expression, "worn-out soil," implies that this was once basically a very rich soil. If it were not, you would not have used the word "worn-out."

There is a popular assumption that all virgin lands are good lands. Some of the very worst in the world are virgin. That is true of many of our forest areas. When they cut off the timber and try to farm them, people starve to death. The effort to make those into good soils is impossible because of the economic cost.

MAKING SOILS

We know today how to make soils, good soils, more productive than 90 per cent of the virgin soils of the world. We can make them out of granite, sand, or blue shale. The only limiting factor is that it costs too much money and you cannot afford to do it.

But you have in this country millions of acres of basically good, deep subsoil on farms which are producing nothing. They are virtually tax-delinquent, and they are called worn-out. They are not at all! They are in that condition because the level of agriculture practiced in the past and in the present in those areas is so low and so unintelligent that the very fertility of those soils becomes unavailable to the crops and, consequently, to the animals and people living within the area.

In any of those areas of so-called worn-out soils the chances are very considerable, with the knowledge we have today, that those soils can be put back into production as great as they ever were and, in most cases, production far above the level of those soils as virgin soils. We all know we can do it.

WE DON'T HAVE TO STARVE

I am personally convinced, along with Dr. Kellogg, that the world could feed itself any time it wanted to, if it wanted to badly enough. I have an article in Atlantic Monthly for July with that as the title.

I know from my own experience -- and I am not only talking about my own farm, but I traveled throughout the United States, watching what is happening -- that what I say is true, that we could, on soil now under cultivation, with the proper agriculture, easily feed three times our population at the present dietary levels. We do not produce anything like the maximum or the optimum yield of any but perhaps 10 per cent of the land now under cultivation.

We forget, too, the economic cost of these things. We made a record in producing food during the war; we produced more food than we ever did before. But never in history has food been prodcced so expensively, because we farmed so many acres to produce a given amount of food. We could have produced the same amount of food on a third to a half less land. If we had had a good agriculture, we would have produced just as much and it would have cost us a third less to produce.

PRICES REFLECT PRODUCTION

If we had a good agriculture on the basis on which industry operates (that is to say, by efficiency and high-yield per man hour and per dollar invested); if we had that kind of agriculture today, the food prices in cities would come down 30 per cent, and the

farmer would be making 20 per cent more money than he is making today.

A farmer cannot produce 20 bushels an acre of corn, or 200 pounds of cotton per acre, and survive; it is impossible. That is what you are paying for when you are paying to subsidize and to put floor prices under such commodities.

You can very easily see that for the man producing 100 bushels to the acre, it will cost him one-fifth in time, wear and tear, seed, labor, taxes, and interest. To produce an ear of corn or a bushel of corn, it will cost him one-fifth of what it will cost a 20-bushel-an-acre farm. That is important to the purchasing power of the farmer, prices to the consumer and taxes to the taxpayer.

INDUSTRY ASSISTS SOUTHERN AGRICULTURE

What Dr. Kellogg said about industry and agriculture moving neck and neck is of the greatest importance, and we have a beautiful example of it going on in this country at this time.

I need not go into the past miserable history of the southern states in the record of their agriculture, economic depression and general decline. I only want to make a statement here which I think I can back up. The southern states would have gone exactly as they went if there had been no Civil War. The Civil War hastened disaster by maybe a generation or two.

That is so because, in the southern states, there was no industry. It was an agricultural area, in which every bit of the money was drained out to the North the minute it was produced.

Henry Grady, perhaps the real pioneer of the New South, once wrote The Epitaph of the Southern Farmer, in which he pointed out that everything concerned with the life of that man (the harness on his mule the lantern, the clothes he wore, everything but what he ate) came from the North. As he said in the oration, nothing came from the South in the life of that man except the soil in which he was buried.

The other thing which happened, of course, was that southern agriculture grew worse and worse. They farmed more acres constantly to produce the given amount of cotton, so it cost them steadily more, until even slave agriculture became insupportably expensive.

THE NEW SOUTH

You have seen the turn-around in the South. If you really want to see a revolution and something of the way in which conditions can be improved, go down to Georgia, Alabama, and particularly North Carolina because, for my money, it is the most progressive state among all of ours.

The agricultural income of North Carolina in five years has increased from 200 million dollars to 800 million. If you go down there, you cannot find shanties and cabins any more; the whole State looks prosperous and it looks even wealthy.

It was not agriculture alone which did that, because industry after industry has moved into North Carolina. The same thing is happening in Alabama and Georgia.

One of the greatest things which came out of the recent war was the dispersal of industry into the South and Southwest, away from these northeastern areas where, in fact, sociologically and even economically, our great cities and crowded industries have become a curse to the nation. This change has brought prosperity to the South.

People used to chop and pick cotton for a miserable wage, for about three or four months a year; today they are work-

ing the year around in industry for good wages. The industrial products made there are bought within the area. The money stays there. Exports of industrial commodities to other areas bring additional money to the South. There is an actual shortage of agricultural labor in some areas. Mechanization has not thrown people out of jobs. It has worked the other way around. An increasing shortage of field labor is rapidly forcing mechanization.

Go down and see what is happening there and what has happened in the last ten or twelve years. It is a beautiful example of the combination of industry and agriculture building up prosperity and health and wealth in a given area.

REVOLUTION IN WHEAT FARMING

Just one more thing and I am through. I am glad the wheat crop was mentioned. It is very close to me, particularly the great panhandle area of Texas. It is the most beautiful example of how erosion destruction in a country can be cured simply by the technological change in farming, and how the prospects of crop failure can be virtually annihilated simply by changing the methods of agriculture.

You remember, in all that Great Plains wheat country that it was the practice in the past to burn off the straw and turn over the land with an ordinary turning plow or mold board. They burned up and destroyed the organic material and turned the soil over and left it bare to both wind and rain. When a rain came, the first thing it did was to make a layer of cement and block the water from going down into the soil; consequently, the water all ran off, and it caused gullies and an immense loss of water.

In the next stage, after they found wheat fields declining rapidly and the soil blowing rapidly away, they put in one-way disks; they left the trash on the surface and disked it in. This was a great improvement, because it helped the soil to absorb the rain and the trash on the surface could reduce a 60-mile gale to eight miles an hour. So that served greatly to check dust storms.

NO MORE DUST BOWLS

I do not believe you will ever see another dust storm, because of an impliment called a Graham-Hoehme plow. It is well known to everybody in the Great Plains area, from the Gulf plains to Saskatchewan and the Arctic Circle. Two shiploads of those plows have just gone to South America to correct the same soil condition existing there.

It is not a plow at all; it just rips up the land, leaving the rubbish on the surface, down to a depth of 18 to 20 inches. No matter how heavy the rainfall, every bit of that rain goes down into the ground; it does not run off, does not create gullies and siltation. The rubbish on the surface serves to insulate it against the wind and sun and cut down evaporation enormously.

There is no dusty surface; there is nothing to blow, and you will not find any blowing farms anywhere in that area today, except here and there, an isolated one, where an ignorant farmer is plowing up and destroying his own capital.

SOIL BUILDING SOMETIMES SIMPLE

That is just one sample of what can be done with modern knowledge. There are today in the South thousands of acres of land on which they tried to raise the green gold of alfalfa to bring back that worn-out cotton land. They could not do it. Finally, the answer was found. It was as simple as two five-pound boxes of Twenty Mule Team Borax per acre, and they could grow all the alfalfa they wanted. That is another element which opened up a whole field which is fabu-

lous in its potentialities, in bringing back into high production land which had become virtually useless.

INDUSTRY DEPENDS ON AGRICULTURE

I think we could feed the world; I think we could feed ourselves and, believe me, as a Director of the Chamber of Commerce, let me say that if you boys in the other industries want to know where your bread and butter is coming from or what it is founded on, it is our soil, our forests, our water and, particularly, our agriculture, and do not forget it!

ANSWERING THE THREAT OF FOREST DEPLETION

By

J. P. Weyerhaeuser, Jr.

J. PHILIP WEYERHAEUSER, JR., lumberman and business executive, is president of the Weyerhaeuser Timber Company, Tacoma, Washington. He is one of the third generation of a great timber-owning and lumber-manufacturing family whose activities now include production of pulp, paper, and plywood. He worked up through the lumber business, and is now active in forest management, reforestation, and the Tree Farm program of the forest industries.

THOSE WHO INSIST America is heading down a one-way street to forest oblivion obviously haven't bothered to check all the facts. Certainly they have not examined the prevailing trends in modern industrial forestry. The basic concept of the timber operator has long since changed from one of migratory trade and temporary holdings to one of permanence based on long range planning and scientific land operation. Our modern economy, rather than posing a growing threat to forest resources, is, for the first time, providing the economic incentive to grow trees as a crop.

TIMBER CROPS ARE PROFITABLE

The realization that timber is renewable was slow in developing. Tree farming and treating timber as a crop became practical only after it became profitable. Until it became a probability that trees could be grown to realize more than the costs of growing, few were interested. Until sometime after the Great Depression of 1932, one could purchase more trees whenever needed at less than the cost of growing them.

FOREST CROPS ARE NECESSARY

Our 345 million acres of private forestlands capable of producing a commercial crop represent over four million different ownerships. Our 116 million acres of similar publicly owned forestland contain a large percentage (43 per cent) of the present inventory of mature timber, but are by and large less capable of growing a large annual crop of timber than the more accessible and fertile private lands. The forest industry, which owns 84 million acres out of this total of 461 million acres of commercial timberland in the country, depends for its existence upon the renewal and wise use of all these lands. Industry's own lands are being treated with increasing care for regrowth, as evidenced by the employment in industry of more than 2,000 forest school graduates at this writing. Wood-using industries' statements of policy increasingly stress the importance of timber cropping. The following is the opening sentence of the "Program of Forest Conservation" officially adopted by the national lumber industry:

"Nothing is more important today to the enlightened self interest of our wood-using industries and the principal groups of wood consumers than to assure an adequate and stable supply of raw materials within the United States."

TREE FARMS

Constructive work in this direction has been done by an industry agency called American Forest Products Industries. Its "Tree Farm Program" has spread the tree-farm movement from a single beginning in the State of Washington in 1941 by our Company to 23 states of the Union, where there are 1,750 organized tree farms covering 17,648,813 acres. Its current "Trees for America Program" is aimed at persuading the more than four million small owners of 261 million acres of commercial forestland that they have a paramount and financially profitable interest in managing their forestland on a crop basis, much as other cropped lands are managed. At the present rate of organization, American Forest Products Industries, Inc., which sponsors these programs in behalf of lumber, pulp, and paper industries, expects to have 30,000,000 acres in organized, carefully supervised tree farms by 1951. These are well-managed forest properties devoted to continous production of forest crops, supervised and organized by foresters employed by conservation committees of lumber, pulp, and paper associations, state forestry organizations, established forestry and conservation associations, and encouraged by Chambers of Commerce and various service organizations. They are supported by the individual efforts of forestland owners and contributions for overhead from industrial groups and state boards of forestry. The cost to the taxpayer is negligible; yet notable results are being obtained.

KEEP GREEN

The "Keep Green Program" is another "grass roots" program similarly sponsored. It also originated in the State of Washington in 1940, and has now spread to 25 states. It functions on a statewide basis and works through county or local committees made up of public spirited citizens from all walks of life. All work is done on a voluntary basis, except for a state director and office services. A.F.P.I. furnishes literature and posters and helps with the original organization in each state. Statewide budgets have been from $5,000 to $25,000 a year, contributed from all sorts of sources. Results have been good. For example, the admittedly good fire year 1948 in the State of Washington produced only 255 forest fires on state and private lands, as against a 20-year average of 958 fires. Only 4,400 acres were burned, whereas the 20-year average was 58,532 acres. The reduction in fire weather gets some of the credit, but fire consciousness of the general public has made a tremendous difference. The public needs to be constantly reminded of the danger, since it pretty generally appropriates the hunting and fishing rights no matter who the record owner.

"MORE TREES FOR AMERICA"

Newest of A.F.P.I.'s national forestry programs is "More Trees for America." Three states--Alabama, Virginia, and New Hampshire--launched More Trees projects in 1948 and a fourth state, Washington, started its Cash Crops program only last month. Other states will follow suit as soon as effective arrangements can be made.

These More Trees projects are grass roots educational programs aimed primarily at farm woodlot owners. The initial interest-arousing phase is followed by on-the-ground demonstrations in which technical foresters show landowners how to manage their woodlands as tree farms. During the course of a More Trees program, practically every small timberland owner in the state is contacted and offered an opportunity to participate.

Booklets, filmstrips, moving picture trailers, and newspaper advertising are prepared by A.F.P.I. and supplied to the individual participating states. A.F.P.I.'s publication "Cash Crops from Your Woodlands" has been used in all the More Trees programs launched to date and has been read by thousands of farmers.

STATE PROGRAMS

In addition to these projects nationally sponsored by A.F.P.I., there are other significant accomplishments in a number of the states. In Wisconsin, "Trees for Tomorrow," an organization sponsored by paper and pulp companies, is planting thousands of acres to young trees and working with the youth of the State in promoting conservation for use. The West Virginia Forestry Council, initiated by forest products industries and composed of many groups interested in forestry, has made a notable record during its two years of existence. New Jersey, Virginia, and other progressive states are giving widespread, practical help to small owners. The southern states expect to increase their state nurseries' output of trees for planting from 150 million to 370 million during 1949. This is just a sketch of the spontaneous state and private contribution to our forestry progress. It should not be underemphasized.

Reference to hundreds of millions of acres and millions of owners calls attention to the fact that appraisal of our forest inventory and its use is such a Gargantuan task that no one feels equal to it except government. All parties to an argument about America's forests perforce go to the United States Forest Service for factual data.

THREAT OF TIMBER FAMINE

We must recognize that since its organization under Gifford Pinchot the Forest Service itself has almost continously "viewed the situation with alarm." It was predicted in 1907, for instance, that the Southern pineries would be cut out by 1920, though the 1944 resurvey found in the 11 southern states 323 billion board feet of sawtimber and an annual growth amounting to nearly 20 billion board feet. In 1919 the Chief of the Forest Service predicted that should another war emergency arise by 1934 we would have very great embarrassment in obtaining even the lumber needed for general construction. Yet the record of war supply was remarkable and not limited by the timber supply.

LEGISLATIVE PROPOSAL

Interpretation of Forest Service data often seems to us in industry to lean toward the thesis that the public must be frightened into acceptance of the big, all-powerful "Let's pass a law" federal approach, offering subsidies and incentives in one hand and threats of federal regulation in the other. This means more and more taxes and more thousands of federal employees who would render ostensibly free services not only on forestry, but also on how to conduct our businesses. House Bill 2223 now before Congress illustrates the concept by providing increased authorizations for the Forest Service at the rate of $23,-500,000 a year to make possible three to four thousand new federal employees.

UTILIZING "WASTES"

We are all agreed on growing more trees for America. Recent years have seen great strides in that direction. Not the least of the actuating forces has been that same rise in values of prime forest material which many of us have viewed askance. The use of lower valued, though more expensively handled, material has been accelerated by the rise in stumpage values. Industry's technological improvements have made the transmutation of small and previously unmarketable pieces or species of wood into pulp for paper, board, or chemical

uses. A wide market for the trees we are all growing will continue to be of utmost importance to forestry.

Out in the West, we're just beginning to find markets for those so-called "wastes" for which the industry has been criticized. No one is going to legislate those markets for us. Hard work in product development and sales as the result of self-interest will produce them. The necessary investment risks also will be taken if the business climate permits, but not via the "crack-the-whip" method. Neither can the millions of forestland owners be so actuated.

Our modern economy is providing a background leading to voluntary renewal of our timber resources, and, instead of being a threat, it furnishes the greatest assurance that these resources will both be renewed and used for the greatest benefit of all the people.

DISCUSSION

CHAIRMAN CARR: We have now come to our discussion period. We have many questions coming in to the head table, but we will have to adjourn at four o' clock as the Chamber's Directors must attend a meeting of the Board of Directors and the ladies are all invited to Mrs. Shreve's tea. We will take up as many of the questions as time will permit.

AGRICULTURAL BALANCE

CHAIRMAN CARR: I have a question here for Dr. Kellogg. "You say that arable land is not formed naturally. Does this imply that good farmland requires an unnatural balance? If so, how can it be sustained?"

DR. KELLOGG: Natural soils are not commonly in the best condition for good agriculture. The opposite of "natural balance" is not an unnatural balance, but a "cultural balance." In other words: on podzolic soils forest vegetation is removed; we use the lime which is necessary for cultivated plants; we raise the amounts of nutrients in the soil; we keep the soil properly covered with legume-grass mixtures; and we use livestock. In that way productivity is developed in a cultural balance through modern technology at a level of yields far above that which the soil has under natural conditions.

In fact, if that were not true, there would be practically no vegetables grown in the eastern United States along the seaboard. There would be no citrus industry in Florida or pineapple industry in Hawaii.

FARM AIDS AND EDUCATION

CHAIRMAN CARR: Mr. Bromfield, I have two questions I am going to read together, and you can answer them together.

"As a farmer, do you think the recent proposal by Secretary Brannan of the Department of Agriculture for a Farm Program is the type of program farmers want in America?" "How are we to educate the poor farmers into good farmers? Is the Farm Bureau inefficient?"

MR. BROMFIELD: I think the first question is answered by the almost universal opposition to the plan arising from the good farmers and from the two major farm organizations--The Farm Bureau and the Grange. Mr. Patton of the Farmers Union has asserted that the Farmers Union, a somewhat leftist organization in some of its manifestations, is for the Brannan Plan, but this, to some extent is a misrepresentation, as some of the state groups, as Nebraska for example, included in the Farmer's Union, are against the plan. Privately I think that it was the only thing our good President could offer to redeem his campaign promises of benefits for everybody, cheaper food and living costs, higher wages and higher prices for the farmers. It would need some magic formula such as the Brannan plan to produce any such thing. You might as well legislate perpetual motion.

As to the Farm Bureau, it is not a government bureau but a cooperative, organized among the farmers themselves, and it does a remarkably good job of education as well as buying and selling farm commodities on a cooperative basis.

It does have in some states a too close connection with the State Colleges and the Extension Service, using taxpayers' money allotted to education for its own purposes. However that is an abuse which probably will be corrected within the next few years.

Another question has been handed me--- " If you haven't done anything in twenty years with our excellent Extension Service, how are you going to improve agriculture?"

Part of the answer is that we have improved the level of our agriculture enormously during the past twenty years — indeed to an almost unbelievable extent. We have progressed from a frontier agriculture living off the virgin fertility of the land to an agriculture which is part business, part science and part specialization. That statement applied only however to our present day good farmers — a maximum of thirty-five per cent.

Agriculture is improving as well for other reasons — one of them the education in modern agriculture being received by the younger generation. Here, the Extension Service, through the Four H clubs, the vocational agricultural classes, and the Future Farmers of America, is doing a wonderful job. The approach of these youngsters to agriculture is altogether different from that of their grandfathers. These youngsters realize that we have become or are becoming an old country like Europe and that farming has become a business in which you invest a dollar to make back three or four dollars.

The other thing which is bringing about improved agriculture is just the bitter economic liquidation of the bad farmer. When he gets below a certain level, he simply cannot operate, even with subsidies, parity, support of prices, and the rest of it. He is just being washed out.

In my own State of Ohio, I think, in another 15 years we will not have any bad farmers, because they are all landing up on the courthouse steps; they just cannot survive. In the meanwhile, with this process of subsidies, what, in effect, are we doing over very large areas, particularly with absentee landlordism? — We have a black widow spider which is very bad in this country, but the black widow spider, in my opinion, is much less harmful than the widow absentee landlord. Too much of the land is owned by widows living in Los Angeles or Chicago, who are only trying to squeeze out of it everything they can. They eventually, too, will be liquidated, in spite of subsidies, because they will get to such a level of production that no amount of subsidization is going to keep them alive.

The Extension Service has one handicap. It is largely speaking, just as good as the local county agent. Where you have a good county agent, he can raise the whole economic standard of a county; where you have an indifferent one, he might just as well not be there. It does not matter how much knowledge there is behind him in the state college or Department of Agriculture.

CONSERVATION EDUCATION

CHAIRMAN CARR: Here is a question addressed to Mr. Osborn, Dr. Kellogg, and/or the others. I will ask Mr. Osborn to answer it.

"What practical suggestions can you offer for the maximum utilization of existing agencies (colleges, universities, and research agencies) for the education and stimulation of the general public in facing the problem and improving and effectively developing the natural resources in presently undeveloped areas within these United States?"

MR. OSBORN: That's a leading question, all right, and goes to the heart of the matter. We have the "know-how" today. The great problem is how to get existing knowledges applied adequately and widely enough throughout the country.

We have all heard a lot of late about the amount of Conservation education at present in our colleges and schools. The New York Times recently printed a summary on the status of such education. The fact is we have barely started to get adequate educational processes in motion. My own feeling is that this situation is definitely on the mend.

Our new Conservation Foundation has been working for more than a year with a large eastern university with the purpose of integrating Conservation teaching on both the graduate and undergraduate levels, including even the establishment of a doctorate in Conservation. If this plan goes through it will be a specific answer to the question that has been asked because I believe this program will be imitated and adopted by many other universities and colleges which are impatient to improve their teaching methods in this field. It must be recognized that there is a dearth of trained teachers on this subject and it will take time to build up a body of competent people who can carry this work forward. Further, there is obviously great need for widespread public understanding of the situation which presumably can only come through the established channels of communication including radio, motion pictures, and of course the press and magazines. I think on the whole the picture is encouraging but a tremendous amount of work needs to be done in building up public interest and at the same time stimulating educational processes so that the oncoming generation will realize what conservation means to the future of our country.

REFORESTING WASTE LANDS

CHAIRMAN CARR: Mr. Weyerhaeuser, this question is for you. "Your report on what the states and private industry are doing to meet our natural-resource problems is very encouraging. What are forest owners doing toward rehabilitating the millions of acres of forest lands which the federal government tells us are now practically waste lands? One agency, the Public Affairs Institute, states that 66 million acres need planting on private forest lands at an estimated cost of $1,945,000,000."

MR. WEYERHAEUSER: I think this report refers to 66 million acres of our forest lands which need to be replanted because they are non-stocked today. That figure isn't correct, by any manner of means. It accumulates all the burned-over land since the forest survey was made sometime in the early thirties. All of the resurveys which have been made since on limited areas have indicated that a great part of this land has come back into timber production.

It seems absurd to think that such a planting program is called for. There has been a good deal of planting done since the twenties and, strangely enough, the private industry has done more than half of it. I think there are some 5 million acres of land which have been successfully planted since records have been kept, of which more than half has been done by private owners.

TROPICAL SOILS

CHAIRMAN CARR: This question is addressed to Dr. Kellogg.

"Do you agree with, or wish to comment on, Dr. Pendleton's observations on the non-volcanic tropical soils, which seem to conflict somewhat with your optimistic views?"

DR. KELLOGG: Dr. Pendleton is professor of geography at Johns Hopkins University and has been somewhat less optimistic than I am about the possibilities in the tropics. I do not know how much difference of opinion there is between Dr. Pendleton and me.

Notoriously, the most productive soils in the tropics are in the volcanic areas, where the soils are kept fertilized by the volcanic ash; or they are on steep slopes of volcanic deposits.

But the reason he feels so pessimistic is because, in many tropical areas, it is practically impossible to get fertilizers. There is no industry. In the absence of such industry, it is true that it is more difficult to have good agriculture on the older soils, which are not kept fertile by volcanic action, than on the young soils.

My own view is based upon rather extensive experiments conducted in the Belgian Congo and some of the British territories far from the volcanoes. If we can have a reasonable development of industry, those soils can be farmed at a high economic level.

I think that is the difference. Without any industry at all -- without hydroelectric power and without a fertilizer industry -- a lot of the soil in the billion acres I mentioned cannot be farmed economically. I know that. But this is true not only in the tropics, but also in other places, like much of the southeastern part of the United States. We cannot develop those lands without combined resource development, both industry and agriculture together.

On the Congo River alone there is more undeveloped hydroelectric power than in the whole of the Soviet Union, developed and undeveloped. I have stood and watched that river come down from Leopoldville, falling over 600 feet, with about 1-½ times the water that goes by New Orleans in the Mississippi. And this in an area where there is good productive land, forests, and minerals. Of course the resources are there.

THE PLOW THAT SAVED THE PLAINS

CHAIRMAN CARR: Mr. Bromfield, this is an easy one.

"Please name and describe the type of plow which you mentioned. Can it be used economically on a small farm?"

MR. BROMFIELD: I can best describe it by saying that, if you have ever seen a spring-tooth harrow, it resembles that, except that there are no springs, to speak of. There are rigid steel prongs, set alternately back and forth, staggered on a bar. It ranges from 8 feet wide to 34 or 36 feet, as used on the Great Plains.

It is the Graham-Hoehme plow. There is another company which manufactures them and has sold them, so, today, it is almost impossible to find an old turning plow. You can put it down to a depth of 18, 20, or 24 inches, according to the condition of the soil. It rips up the soil down to that depth. Sometimes they drill the wheat right in.

I might add something I neglected to say on the technological side of this revolution. You notice we have had no such thing as a wheat-crop failure in that area since 1939. The rainfall, on the average, was just the same as always but the record for three crops of wheat in the country up to then, was usually one failure, one fair crop, and one good crop. We have had nothing but bumper crops when we got the water down in the ground.

So today we can get a wheat crop on 11 and 12 inches of rain, whereas they used to need 16 and 17 inches, because as much as 4 or 5 inches was lost and never got into the ground at all.

It is not practical in the East particularly; for some operations it is, but it is essentially a plow for dry, arid areas and for wheat cultivation. They use it all over; we use it on our farm occasionally, but it is a specialized operation in the eastern part of the United States.

TIMBER GROWTH AND DRAIN

CHAIRMAN CARR: This one is for Mr. Weyerhaeuser:

"Do you wish to answer this one? Isn't it true that the actual timber growth is now substantially equal to the cut?"

MR. WEYERHAEUSER: I think it is true if you mean the drain on all timber. At least it was practically so in 1944, and I think the situation has probably improved since then.

At that time, according to the Forest Service resurvey figures, the total drain on our forests represented 1.02 times the growth. That was a few years ago, but things have been improving since, so I think the correct answer to that question is "Yes."

LABOR COSTS AND THE PRICE OF LUMBER

CHAIRMAN CARR: Mr. Osborn, this question is for you:

"The price of lumber is made up of several factors, including the price of standing timber and the costs of harvesting and manufacture. Relative to the increasing lumber prices to which you referred, what percentage of the increase is due to increased labor costs?"

MR. OSBORN: I cannot answer that one specifically. I might recall to the questioner that my earlier statement was that the general commodity index has advanced 100% in the last 16 years and that lumber prices have advanced 250% in the same period. I would presume that the labor costs both directly and indirectly in the price structure which make up the general commodity index, would be approximately equivalent to those labor costs that are involved in the lumber industry. Consequently, it would seem that the great increase in lumber prices is due in large part to the increase in prices of standing timber. Perhaps the questioner will concur that the growing scarcity of this commodity has a good deal to do with such increased lumber prices.

FARM LABOR

CHAIRMAN CARR: One more for Dr. Kellogg.

"How close can industry come to the farm without tempting labor away by its labor unions and shorter hours?"

DR. KELLOGG: I am delighted to comment on that question, because I do not believe in having one set of rules for the farm boys and girls and another set of rules for the city boys and girls. The closer industry and farms come together, the better I like it.

In an efficient agriculture, there is no reason why the boys and girls should have to work any harder or any longer hours or with any less of the modern conveniences than the boys and girls in the city.

We have city slums, which one speaker referred to; we also have rural slums. With modern transportation and modern communications, there is no need for either. We need to think of large areas where there will be enough people to have good department stores and good theaters and Boy Scout clubs and singing clubs and art clubs for both the boys and girls in industry and the boys and girls in agriculture. So, as far as I am concerned, the closer and the faster we can bring them together, the better.

MR. BROMFIELD: I just want to put in

this one word. I will have to back up what he says, that today, on any farm which is operated efficiently, the one thing you cannot afford is cheap labor. The economic level of people operating farms today is steadily getting higher.

We would not have anybody on one of our farms who is not a skilled laborer. The hired man is a thing of the past. He can go around and pick up, mend fences, or something like that, but you cannot afford to leave any of the operations on the farm at the level of the hired man. He is rapidly disappearing, and any good farm today just does not have him around. They are all getting wages on the same level as the industry people. That is one of the troubles with the absentee lands; they are run by cheap labor.

FOREST GROWTH AND DRAIN

CHAIRMAN CARR: The last question is directed to Mr. Weyerhaeuser. We have many others here, but time has run out on us.

"With lumber cut in 1946 to 1948 some 3 billion board feet greater than in 1944, what is the basis for your belief that growth-drain ratio has improved since 1944?"

MR. WEYERHAEUSER: Lumber is only one element of the drain. There are plenty of other drains on the forests, as you know.

This question requires definition of the relationship between the total drain on the total forest and the growth and drain on what has been termed "saw timber."

Mr. Osborn referred to our overcutting our saw timber at the rate of 1.5 times the growth. I cannot make much sense out of the statement, because it does not really mean very much to pick one point and say the saw timber is being overcut at any particular rate.

This last question bears on the same point. Foresters are pretty well agreed that mature timber, which is our backlog, is, by and large, stagnant. There is no net growth. When you have a large reserve of mature timber still in inventory, it is good forestry to overcut, because the best balance can never be reached until you have all of the timber land in various age classifications of growing timber.

That gets into a technical matter which the foresters had better take over, if you really want to argue on it, because I cannot.

CHAIRMAN CARR: I think you quiz kids have done a wonderful job. I think everyone is convinced that there was no rehearsal of these questions.

The Chamber is indebted to every one of you and is grateful to the others who came. I know this has been a profitable meeting, and I am only sorry that time stops us here.

The meeting is adjourned.

CHAMBER POLICY

The roundtable symposium on OUR RENEWABLE RESOURCES CAN BE SUSTAINED, presented at the 37th Annual Meeting of the Chamber of Commerce of the United States, and reported in this publication, was organized as an educational feature to promote greater public interest and understanding on this most timely subject. The Chamber is not bound by any of the ideas presented by the speakers, nor were the speakers bound by Chamber policy.

The Chamber's policy declarations on this and other natural resources and agricultural subjects are published. Anyone interested may receive them by writing to the Natural Resources Department or the Agricultural Department, Chamber of Commerce of the United States, Washington 6, D. C.

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Land Use, the Basis of Western Economy[1/]

by

S. V. Ciriacy-Wantrup[2/]
University of California

It may be assumed that your Executive Committee, when assigning the title of my paper, was interested in the major changes and problems of western land use created by the Westward Migration. The "West," for our purpose, includes the three Pacific Coast states (Washington, Oregon, California) and the eight Mountain states (Idaho, Nevada, Arizona, Utah, Montana, Wyoming, Colorado, New Mexico).

Changes in Relative Importance of Agricultural Employment

First, let me caution you about the semantics of the word "basis." The term may mean merely that land use is highly important for the western economy. This is certainly true; but it is also true for transportation, manufacturing or the service industries. If the term connotes a kind of economic pyramid of which land use is thought of as the broadest segment, we may easily be led astray. Farm population and agricultural employment was possibly the broadest segment of the western occupational pyramid until the beginning of this century. Today, the farm population comprises only sixteen per cent of the total western population. The corresponding figure for the United States as a whole is twenty six per cent. Likewise, workers in agriculture are now only sixteen per cent of all western gainfully employed against nineteen per cent in the United States as a whole. The original occupational pyramid with land use at the base is now completely inverted (table 1).[3/] This inversion is more extreme in the West than in the United States as a whole.

1/ Paper presented at the Divisional Symposium, "The Westward Migration and Its Consequences," Annual Meeting, Pacific Division, American Association for the Advancement of Science, Salt Lake City, June 19-24, 1950.

2/ Professor of Agricultural Economics, Economist in the Agricultural Experiment Station and on the Giannini Foundation.

3/ Tables appear on page 12.

Land Use, the Basis of Western Economy[1]

by

S. V. Ciriacy-Wantrup[2]
University of California

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In this change, allowance must be made for employment in agricultural processing and distribution industries, which is considerable in the West--somewhere between 15 and 20 per cent of total manufacturing employment. On the other hand, in terms of national income, per-capita productivity in agriculture is less than in other industries. Furthermore, my data refer to the Census of 1940. If data from this year's Census were available, they would show an acceleration of the trend toward urbanization and industrialization of the West.

Changes in the Relative Importance of California

The second change under the impact of the Westward Migration is mentioned with some reluctance by one who comes from California: Boosters for California are not a very likable species. Still, it is a cold fact of great importance for the whole western economy that the economic weight of California has increased greatly.

In absolute numbers, population growth in the West was most rapid in California; at present more than half of all western people live in California (table 2). As will be shown presently, an almost identical situation prevails in the growth and the relative weight of California's agricultural production.

In spite of this growth, California's farm population and farm employment has actually declined since 1930. In 1940 the California farm population was only nine per cent of the total population, and agricultural employment only ten per cent of all gainfully employed.

The relative importance of natural increase and migration has been studied more thoroughly for California than for the other western states. Natural increase was relatively unimportant compared with the net effect of migration (table 3).[1/] This fact does not necessarily indicate that all westward migrants went directly to the cities; some of them did and some of them replaced native-born workers who left agriculture. But there is no doubt that the Westward Migration has been and is the

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1/ Adapted from page 107, Statistical Memorandum No. 6 (Migration) Population Committee for the Central Valley Project Studies, Bureau of Agricultural Economics, Berkeley, 1944, 264p. Processed.

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1/ Adapted from page 107, Statistical Memorandum No. 6 (Migration) Population Committee for the Central Valley Project Studies, Bureau of Agricultural Economics, Berkeley, 1946, 55pp. Processed.

most important factor in the urbanization of California and its increased economic weight among western states.

Changes Within Western Agriculture

The third change in the western economy under the impact of the Westward Migration concerns shifts in agricultural production. Measured in terms of an appropriate common denominator, over-all agricultural production has kept pace with population growth. However, the composition of total agricultural production has changed significantly (table 4).[1/] Emphasis has shifted from field crops toward fruits and nuts and from meat animals toward dairy and poultry production. In this shift, as well as in total increase of production, California has taken the lead to an extent similar to that in the increase of population (tables 2 and 4). The result is that about half of western agricultural production originates in the most highly industrialized western state.

The expansion of agricultural production was due partly to an expansion of acreage and partly to an expansion of inputs and outputs per acre, that is, to an increase of land-use intensity. Up to about 1930 expansion of acreage predominated; after 1930 land-use intensity was the more important factor. This tendency toward stability of acreage in farms and in cropland and toward increases in agricultural intensity is also more pronounced in California than in the other ten western states.[2/]

The most important aspect of increased intensity of land use is greater importance of irrigation. The shifts in production from field crops to fruits and vegetables and from meat animals to dairying reflect largely the increased importance of irrigation farming. In the West as a whole approximately half of the cash farm income is produced on irrigated land. Of crops nearly three fourths is so produced,

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2/ Ciriacy-Wantrup, S. V. Major Economic Forces Affecting Agriculture, Hilgardia. vol. 18, no. 1, Berkeley, California, December 1947, 76p.

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but of livestock less than one third. These percentages vary greatly between different western states. In Arizona, Idaho, California, Utah, Colorado, and Nevada more than two thirds of total cash farm income is produced on irrigated land. In Oregon and Washington less than one third; the other western states maintain a middle position.

In view of the large public irrigation developments which are being built or authorized in most western states, the shift towards irrigation agriculture and toward those types of production based on it can be expected to continue.

Let me summarize the changes in the western economy under the impact of the Westward Migration.

First, the West now displays the signs of a maturing industrial economy; that means the relative importance of agricultural employment is decreasing, and increases of agricultural production are based more on greater intensity of land use than on acreage expansion.

Second, the greater intensity of land use finds expression mainly in an absolute and relative increase in the importance of irrigation and in shifts towards production patterns associated with irrigation farming.

Third, the greatest absolute growth in population and agricultural production took place in California. About half of western people and of western agricultural production are now concentrated in California. Simultaneously, the economic maturing process--that is, urbanization, industrialization, and the intensification of agricultural production--has gone furthest in California.

Land Use Problems Related to the Westward Migration

Even in an industrial economy, problems of land use may still be basic in the sense of highly important. For the West this is true for a particular reason, namely, the scarcity of water. In the West, land use means water use and vice versa. Urbanization and industrialization has not eased the West's water problems. On the contrary, in many respects these problems have become more acute. We may

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as, therefore, how are western problems of land use and issues of land use policy related to the Westward Migration? The answer to this question contains the central theme of my discussion today:

When people migrate, they take with them their collective experience, their customs, their laws--in short, their social institutions. Social institutions I have especially in mind are the customs with respect to "good husbandry," the laws relating to property in land and water, the traditions regarding tenancy, the systems of credit and taxation, the experience with and the legal framework for cooperation and for the formation of self-governing districts in the field of irrigation, flood control and conservation. The importance of this "institutional baggage" of the Westward Migration is frequently underestimated. True, some resources, particularly water, are scarce in relation to population over many areas of the West. However, if the social institutions influencing land use were well adapted to this scarcity, most of the problems which are now faced in conserving western water, soil, forests, and grasslands could be solved without difficulty. Social institutions well adapted to the humid and fairly consistent climates of England and of the eastern United States, but ill suited to the arid and highly variable climates of the West, are more significant for western land use problems than scarcity of resources, or negligence and antisocial attitudes of resource users. In short, the institutional baggage of the Westward Migration has long been and still is an important cause for resource depletion in all western states.

Social institutions are created by man and can be changed by man. Social institutions may be either obstacles or tools of land-use policy. In order to clarify this important issue, I should like to give you a few illustrations of the institutional adaptations which became necessary as a consequence of the Westward Migration. Let us start with the laws relating to land and water use.

Adaptation of Land and Water Laws to the Western Environment

Several laws carried with the Westward Migration were so unsuited for the new environment that adaptation started almost immediately. Modification of the

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homestead laws, particularly the upward revision of the maximum farm size (Enlarged Homestead Act, Timber Culture Act, Desert Land Acts, etc.) is an example. In the 1890's and early 1900's there followed withdrawal of large portions of the public domain for watershed protection. Later the free-for-all competitive grazing of the remaining public domain was changed to more orderly use through the Taylor Grazing Act (1934). Another important illustration is the replacement of the English and "eastern" riparian doctrine in surface water law by the appropriation doctrine under the governing principle of "reasonable beneficial use." No western state restricts rights in surface streams to riparians; some western states, like California, recognize a combination of riparian and appropriation rights. With respect to ground water, the English and "eastern" doctrine of ownership of the "corpus" of ground water by the overlying landowner is still in the process of adaptation. A majority of western states--New Mexico, Oregon, Utah, Nevada, Washington, Wyoming, and Arizona in that order--have passed laws declaring outright that ground waters are public and that private rights must be acquired through appropriation procedures subject to existing rights. California applies the doctrine of "correlative rights" to ground water.[1/] This doctrine may be regarded as a western adaptation of the riparian doctrine; there are indications, however, that California also moves in the same direction as the majority of the western states.

In some cases western conditions required entirely new laws. Examples are the Federal Reclamation Act of 1902 with its many amendments and the Caminetti Act (1893) in hydraulic gold mining. State laws governing the formation of irrigation districts had to go through a considerable period of trial and error before they became adapted to the western environment. In most states, legislation on flood control and soil and water conservation is still in the experimental stage.

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Adaptation of Customs of "Good Husbandry" to the Western Environment

With respect to customs of good husbandry I may mention three examples of adaptation to the western environment:

The first is adaptation of field boundaries and of land-use practices to the contours. The justified pride with which a good farmer in western Europe or the eastern United States may look upon a "straight furrow" is misplaced under topographic and climatic conditions prevailing in the West. The system of rectangular survey, regardless of topography, which originated in the eastern United States, is an important institutional factor retarding adaptation of land use to contours.

Second, in humid areas farmers have acquired the custom of fighting weeds by clean cultivation and plowing. When first applied in the West in the form of clean-cultivated fallow, the beneficial consequences in conserving moisture tended to strengthen this custom. However, serious wind and water erosion followed. Farmers are learning that under western conditions mulching, shallow cultivation and spraying for weed control are better suited to conserve moisture and to prevent wind and water erosion.

The third example of adapting customs of good husbandry to western conditions relates to proper quantities and timing in applying irrigation water. After the migrants learned how productive western soils can be with irrigation, they tended to do too much of a good thing. Overirrigation is not only wasteful of the most important western resource; it may, in addition, create serious problems of ground water pollution, alkali accumulation, and leaching. Sometimes customs with respect to modes of payment for surface delivery of irrigation water strengthen the tendency to overirrigate. If such payments are not related to the quantity of water consumed per acre or per farm, the user has less incentive to apply water economically. In ground water use, high fixed costs of modern pumping plants, and electric power rates strongly graduated in relation to amount of power consumed per unit of time, are institutional factors which favor overirrigation after the pumping equipment has been installed.

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Adaptation of Land Tenancy, Credit, and Taxation to the Western Environment

Next, let me mention some illustrations of my thesis from the fields of land tenancy, credit, and taxation. All three institutions frequently give rise to fixed charges. Fixed charges may induce resource depletion when incomes of resource users go down, and there are no other economic alternatives. The major difference between western and eastern conditions--next to the absolute scarcity of water--is the great variability of precipitation in the West. In dry farming and grazing, particularly, variability of precipitation is directly related to variability of income. Furthermore, dry farming and grazing are one-crop enterprises with a limited range of economic alternatives. For these reasons fixed charges tend more toward resource depletion in the West than in the East. There are many possibilities for making rent, interest, amortization and tax payments more flexible with income: All these charges can be directly related to gross or net income.[1/] Such adaptation is proceeding slowly.

There are many other directions in which land tenancy, credit, and taxation require adaptation to the western environment in the interest of better land use. In land tenancy, for example, the relations between public landlords and livestock operators as tenants, is of particular importance for western land use. The various tenure problems of Indian lands are likewise of special interest in the West. In the field of land credit, until very recently, the West has had higher interest rates and less adequate banking facilities than the Middle West and East. This has been a force tending toward depletion of western soil, forest, and grazing resources. Using livestock as collateral is fairly harmless for land use in the East. In the West this custom has induced overgrazing when the creditor objected

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to a reduction of the herd desired by the debtor in the interest of range conservation. In the field of taxation one may mention as a peculiarly western problem the reimbursing of local governments for taxes lost on publicly owned land. Local groups would less often oppose expansion of federal landholdings for conservation purposes if this problem received more attention in economic analysis, public information, and federal legislation.

Many Problems of Institutional Adaptation to the Western Environment Remain

When we now take a look toward the future, as was implied in several of my illustrations, the adaptation of social institutions to the western environment is in progress but is by no means completed.

Among problems which remain one may mention the relation between federal laws and state laws in the development of western water resources, financing and allocating costs for such developments, and safeguarding of the great recreational resources of the West against uses with more tangible but not necessarily greater economic significance.1/

California is behind other western states in adapting existing legislation to the needs of ground water conservation, but through recent acts has made considerable headway in attacking the problem of water pollution.2/

In western flood control zoning is often the economically most desirable tool of land use policy. This tool is seldom used because of the influence of partisan groups and insufficient information of the public.

The western states have successfully developed the legal framework for employing self-governing districts in the field of irrigation and water conservation.

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1/ Ottoney-Mantrupp, S. V. "Multiple and Optimum Use of Wild Land Under Different Economic Conditions." Journal of Forestry, vol. 36, no. 7, July 1938, pp. 665-674.

2/ These data were well discussed in: California. Legislature. Assembly. Interim fact-finding committee on water pollution. Report. Sacramento, Calif. State print. off., 1949. 172p.

In the field of soil conservation such a development has been spotty. Since the 1930's soil conservation districts have multiplied rapidly in the West. However, only two state soil conservation district laws--in California and Colorado--give limited taxing power to soil conservation districts. Such power is the most important instrument for cooperative action by irrigation and water conservation districts. The significance of soil conservation districts for regulating land use practices has been very small. Regulations have been adopted only by a few districts. Enforcement has not been tested before the courts. In the past, the influence of soil conservation districts upon land use has been largely in the field of education. Eventually, however, soil conservation districts may become an important institutional tool for cooperation and self-regulation by land users.

Time does not permit me to give you more examples of institutional adaptations still needed in western land use. I would rather like to touch upon some factors which tend to retard such adaptation. Probably the most important factor is public misinformation. I say intentionally "public" because information of farmers and other resource users is not enough to obtain proper legislation. As indicated in the beginning of my paper, the voting strength in the West has shifted to the cities. It is essential, therefore, that the general public understands our land use and water problems. Such an understanding is not aided by the great emphasis which recently has been placed on population pressure as a cause of resource depletion. Thus, in conclusion, I should like to say a few words about the relation of my thesis to the Neo-Malthusian doctrine.

Conclusion: Our Thesis in Relation to Neo-Malthusian Doctrine

My thesis was that the major problem in western land and water use is not to alleviate population pressure and to overcome negligence or antisocial attitudes of farmers and other resource users, but to adapt the institutional baggage of the Westward Migration to new environmental conditions. This is the essential problem of human ecology in the West. By contrast, in the view of the modern

In the field of soil conservation such a development has been spotty. Since the 1930's soil conservation districts have multiplied rapidly in the West. However, only two state soil conservation district laws—in California and Colorado—give limited zoning power to soil conservation districts. Such power is the most important instrument for cooperative action by irrigation and water conservation districts. The significance of soil conservation districts for regulating land use practices has been very small. Regulations have been adopted only by a few districts. Enforcement has not been tested before the courts. In the past, the influence of soil conservation districts upon land use has been largely in the field of education. Eventually, however, soil conservation districts may become an important institutional tool for cooperation and self-regulation by land users.

Time does not permit me to give you more examples of institutional adaptations still needed in western land use. I would rather like to touch upon some factors which tend to retard such adaptation. Probably the most important factor is public misinformation. I say intentionally "public" because information of farmers and other resource users is not enough to obtain proper legislation. As indicated in the beginning of my paper, the voting strength in the West has shifted to the cities. It is essential, therefore, that the general public understands our land use and water problems. Such an understanding is not aided by the great emphasis which recently has been placed on population pressure as a cause of resource depletion. Thus, in conclusion, I should like to say a few words about the relation of my thesis to the Neo-Malthusian doctrine.

Conclusion: Our Thesis in Relation to Neo-Malthusian Doctrine

My thesis was that the major problem in western land and water use is not to alleviate population pressure and to overcome negligence or antisocial attitudes of farmers and other resource users, but to adapt the institutional baggage of the Westward Migration to new environmental conditions. This is the essential problem of human ecology in the West. By contrast, in the view of the modern

Neo-Malthusians, depletion of soil, forests, and grasslands is largely caused by the pressure of people upon the land. They propose, therefore, checks on population increase as a condition and as a tool of resource conservation. With respect to foreign countries some of them go even so far as to suggest that medical and nutritional assistance be withheld in order to keep the famous Malthusian checks operative, or to force people to practice birth control.

I am not concerned here with the ethics and the practicability of these proposals. I am interested in their relation to resource conservation. With respect to this relation two observations are pertinent: First, depletion of soil, forests, and grasslands can be observed on a large scale in areas of the world where population pressure relative to that in other areas is very slight. This is true whether population pressure is measured by some kind of man/land ratio, or in terms of death rates, life span, or income level. Examples are not only the area we are concerned with here--the western United States--but also Australia and the Union of South Africa. On the other hand, in many areas of the world resource conservation has been practiced in spite of a high population pressure. Examples are the Inca Empire of ancient Peru, medieval Europe, present-day Japan, and parts of China. All these areas are characterized by highly developed institutional patterns regarding land and water use. It is apparent, therefore, that a high population pressure is neither a necessary nor a sufficient condition for resource depletion. Too much emphasis on population pressure has confused the social and economic issues involved and tends to retard public awareness and acceptance of those institutional adaptations which are needed in western land use.

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Tables

Table 1. Relative Importance of Agricultural Employment (1940)

	United States	Eleven western states	California
	per cent of gainfully employed		
Services	28	32	35
Distribution	23	28	30
Manufacturing	28	21	23
Agriculture	19	16	10
Other extractive industries	2	3	2
Total gainfully employed	100	100	100

Table 2. Population Growth

	Eleven western states	California
	millions	
1900	4.1	1.2
1910	6.8	2.4
1920	8.9	3.4
1930	11.9	5.7
1940	13.9	6.9
1950 (est.)	(17.5)	(9.8)

Table 3. Natural Increase and Net Effective Migration, California

	Natural increase	Net effective migration
	thousands	
1900-1910	115	775
1910-1920	170	880
1920-1930	370	1,882
1930-1940	177	1,050

Table 4. Shifts in Agricultural Production

	Average annual deflated cash farm income in million dollars		Percentage increase
	1910-1914	1939-1943	
	Eleven western states		
Fruits and nuts	170.2	423.5	149
Vegetables	71.2	264.5	271
Other crops	310.2	533.0	72
Meat animals	319.3	512.7	61
Other livestock	173.3	516.5	198
Total	1,044.2	2,250.2	115
	California		
Fruits and nuts	121.1	329.8	172
Vegetables	38.0	161.3	324
Other crops	74.4	185.6	149
Meat animals	72.5	124.9	72
Other livestock	77.5	219.9	184
Total	383.5	1,021.5	166

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Clatsop county, Oregon. Land use survey 1941

CLATSOP COUNTY OREGON

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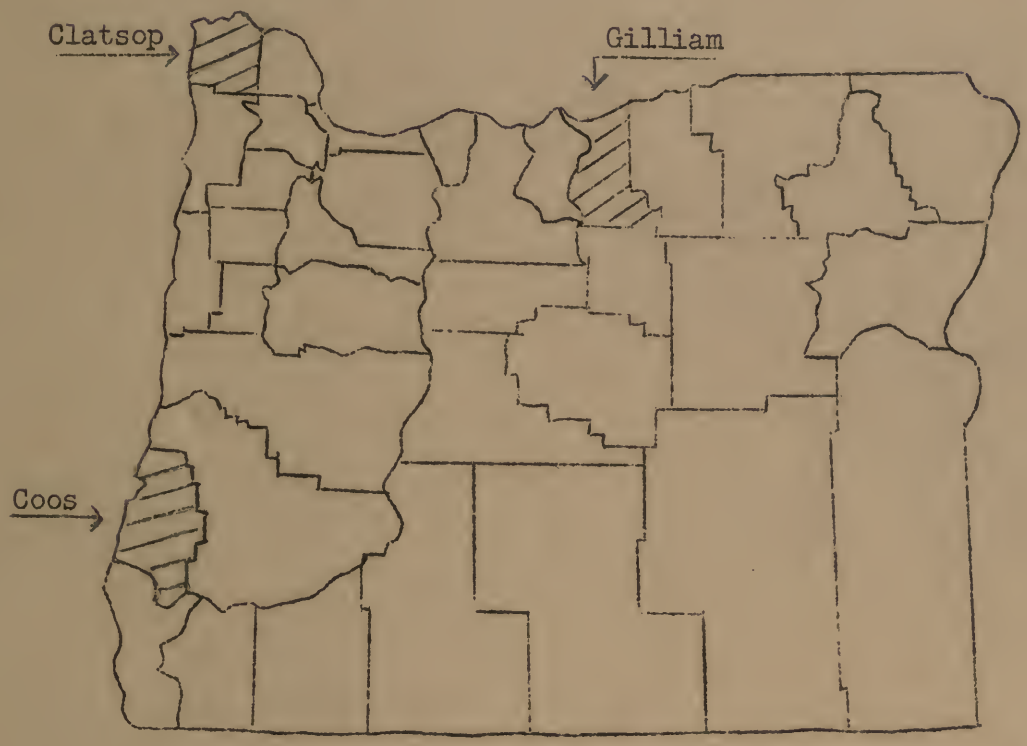

LAND USE REPORT

November 30, 1941
Prepared by County Land Use Committee in Cooperation
with Oregon State College and the United States
Department of Agriculture

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FOREWORD

The following report of the Clatsop County Land Use Planning Committee is based upon the findings and recommendations of the four community land use planning committees. These four community committees represent all rural sections of the county.

During the two or more years that this report has been in the process of development a thorough consideration has been given to the land use problems of the county. Community mass meetings have been held in each of the four communities, numerous community committee meetings have given the problems detailed local consideration, and finally, the County Land Use Planning Committee has carefully analyzed the reports that came from the community committees. Supplementing the community reports have been the factual information and suggestions presented to the county committee by representatives of business, county and state government, the several agencies of the United States Department of Agriculture, and Oregon State College. All these sources have been considered in the preparation of this report.

Clatsop county is confronted with many problems. Ways and means for meeting these problems are very apt to change. Consequently the recommendations found in this report are expected to be changed to meet such changes as they occur. This report should be considered as representing the best thought of the Clatsop County Land Use Planning Committee at this time.

A. E. Engbretson, Chairman

A. Zundel, Secretary

Note: This is the third Oregon county to complete an intensive report on local land use problems. Coos and Gilliam are the other two.

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A. E. Engbretson, Chairman
A. Zundel, Secretary

James Elliott
John Glatte
H. B. Howell
Mark Johnson
Wm. Larson, Jr.
C. W. Laughlin
John Pedersen
Fred Poole
Wm. Wage
F. H. Wooden
Lee Wooden

Community Land Use Committees

Astoria

A. E. Engbretson
A. Filliger
K. F. Johnson
Hiram Johnson
Floyd Reith

Seaside-Pacific

Fred Poole
Albert Harshberger
Charles Johnson
Chet McConnell
Earl Pickering

Columbia

John Pederson
Gust Anderson
Arthur Erickson
Sven Fendel
H. O. McEntire
Fred Rudat
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Nehalem

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Al Berg
Gus Wanstrom
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INTENSIVE LAND USE REPORT

CLATSOP COUNTY, OREGON

SUMMARY

The lands of the county have been classified by the land use committees according to their major recommended uses as follows:

Agricultural areas	173,466	acres
Forest areas	335,767	"
Urban and misc.	15,567	"
Total county acreage	524,800	"

Major problems affecting the agriculture of the county as found by the committees are summarized as follows:

Taxation

The decline in taxable valuation of the county of 59 percent during the period 1925 to 1937 has seriously affected the operation of an adequate county government and maintenance of public facilities. Methods that can be used to increase the tax base of the county include development of grazing on approximately 118,000 acres of logged-off land in the Nehalem community, the bringing under cultivation of suitable lands through land clearing, increasing the forest resources by protective measures and intensive management, and the development of a policy of administering tax-reverted lands to insure a return from these lands in the future.

Forestry

Approximately 335,767 acres in the county have been designated as primarily suited to forest production. It is entirely probable that experimentation and research may develop other uses for at least a part of this acreage, which is tentatively indicated for forest production. The major problem of the area is the reforestation and management of the logged-off lands. Part of this area is now in weeds and brush and will require several decades before seed trees become established, and the area can be reforested naturally. However, the greatest portion of the logged-off land now supports a stand of second growth timber.

It is felt that the lands which are producing timber should be blocked into units of from 5,000 to 8,000 acres, surrounded by open grazing land. Past experience has shown that unless forests are protected it will be very difficult for them to reach maturity because of the fire hazard.

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It is felt that the lands which are producing timber should be blocked into units of from 5,000 to 8,000 acres, surrounded by open grazing land. Past experience has shown that unless forests are protected it will be very difficult for them to reach maturity because of the fire hazard.

The committee has concluded that because of the long period required for the production of timber, with the exception of some of the pulp species, reforestation cannot be carried on by private enterprise, and reforestation areas will have to be managed by either federal, state, or county agencies. The objection to reforestation by the state or federal government is that control of the forest lands would be in hands outside the county.

A cooperative arrangement by the federal and state forest agencies and the county for the reforestation of logged-off lands in this district is suggested, with the provision that the selection of areas to be reforested by the different agencies would be left in the hands of the county. Investigations concerning the formation of county forests from tax-reverted, logged-off lands, it is felt, should be made prior to the organization of such forests.

The development of processing plants in the county to handle the large supply of pulp species of timber is recommended so that this timber will not continue to be a cheap reservoir of supply for processing plants in other sections.

Farm Credit

The greatest need for credit at the present time, which is not being met, is for the development of grazing on adapted deforested lands in the Nehalem community. Assistance is needed from credit agencies for financing the purchase and seeding to grass of lands in this area, and for the adequate stocking of these lands. A need for credit to enlarge and improve dairy units has also been indicated by farmers in some sections of the county.

Grazing Development

One of the most important problems in the county is the proper utilization of non-restocked deforested areas. Based upon results of experiments conducted at the Northrup Creek Experimental Grazing Area and the experiences of individual operators, the community land use committee has classified an area of approximately 118,000 acres of deforested land in the Nehalem river watershed as suitable for seeding to adapted varieties of grass to be used for livestock grazing. This development is under way at the present time with approximately 3,600 acres seeded. The establishment of grass stands by methods which have proved satisfactory at the experiment station and on individual ranches is recommended. It is also recommended that the area designated for grazing development be classified under Title 107, Chapter 4, O.C.L.A., as a Class 3 agricultural area.

Units of not less than two sections of land are recommended as a minimum size when the entire income is to be received from the operation of livestock.

The development of strips of grazing land in the forest sections of the county is recommended so that protection from fire can be given to the adjoining blocks of timber.

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The development of strips of grazing land in the forest sections of the county is recommended so that protection from fire can be given to the adjoining blocks of timber.

Soil Fertility

The maintenance of soil fertility is a problem in all of the farming areas of the county, but more particularly on lands continuously under cultivation and on hill soils. Livestock enterprises are considered to be necessary, especially on hill or benchland farms to aid in maintaining soil fertility. The conservation of barnyard manure should be practiced on all farms where livestock are kept, and an increase in the use of liquid manure tanks is felt to be desirable.

In addition, in order to maintain and to improve soil fertility, the use of green manure crops, where barnyard manure is not available, and of commercial fertilizers, as nitrates, lime, and phosphate, is recommended. All cultivated lands should be included in a rotation consisting of two years of cultivated crops with at least four years in grass.

Drainage

Drainage is a problem on much of the low bottom land and tideland in the county. At the present time most of the tidelands are protected by dikes. The type of drainage that is needed in most cases is interior drainage, which is an individual problem. Because proper drainage where needed will increase the productive capacity on the farm land, it is recommended that assistance be provided by the Extension Service in planning and surveying individual farm drainage systems. In addition, it is suggested that payments for the establishment of individual drainage systems be provided under the agricultural conservation program.

In the western part of the county drainage can be improved by the clearing out of debris from parts of the Necanicum river and of Muddy creek. Assistance with this problem can be provided through the soil conservation district that is organized in this area, and aid can be given in the securing of needed drainage in the Cullaby lake district.

Size of Farm Unit

In all communities in the county there are numerous small part-time farms whose operators at the present time are employed principally in the logging industry. These farms, in most cases, are located on the hill or benchlands of the county. The decline in the logging industry which is expected with the depletion of much of the county's timber resources will create a problem for the operators of these part-time units. The problem is expected to become even more acute if the present operators of these farms leave, and their places are taken over by new settlers who have little knowledge of the size of farm unit required to support the average family. A necessary adjustment that will need to be made will be to combine part-time farms into economic sized units, or, where suitable land is available, some of the small farms may be enlarged by clearing additional acreage.

Farm Pasture Improvement

The maintenance of farm pastures is vitally important to the dairy industry. Forty-three percent of the total tillable acreage of the county

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is at the present time in plowable pastures. As a result of experimental work, pasture mixtures have been developed which are adapted to all types of land in the county. In addition to the use of these mixtures, the rotation of grazing on farm pastures is a recommended practice.

Land Clearing

It is estimated that there are 5,000 to 6,000 acres of good land in the county that would be suitable for cultivation if cleared. These lands are principally located along the Nehalem, Necanicum, Youngs, Lewis and Clark rivers, and other smaller streams in the county. Such lands should be developed for agriculture in order to increase the size of existing uneconomic farm units or to form new farms. The use of bulldozers and other heavy equipment has proved to be the most economical method of land clearing and should be used in clearing these areas.

It is expected that efforts will be made to clear land in the county, which, because of location or soil type, is not adapted to cultivation. Cost of clearing these lands will either equal or exceed the value of the land after it is cleared. For this reason, it is recommended that all farm owners who are contemplating clearing additional land consult soil maps which are available for all farming areas in the county.

Irrigation

There is a deficiency of rainfall during the summer months in the county, and farm lands which are not subirrigated will benefit from supplemental irrigation. In most cases the sprinkler method of irrigation is best adapted, although in a few localities gravity irrigation systems from small streams may be installed.

Soil Erosion

There are two types of serious erosion occurring in the county: (1) streambank erosion along the coastal streams, and (2) wind erosion in the sand dune area in the Warrenton community.

A soil conservation district has been organized to include Necanicum river and the Warrenton area, and steps have been taken to control the erosion. In the case of the sand dune area it is recommended that both farming and grazing be prohibited in order that the area may be stabilized and to prevent damage to adjoining agricultural lands. Continued work on controlling the streambank erosion along the Necanicum river is recommended.

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INTRODUCTION

Clatsop county is located in the extreme northwest corner of the state and is bounded on the north by the Columbia river and on the west by the Pacific ocean. General settlement of the county began about 1870.

Principal cities in the county include Astoria, which is the county seat, with a population of 10,389; Seaside 2,909; Warrenton 1,365; and Hammond 422.

The major industries of the county are fishing and lumbering.

Purpose

Land use planning has been developed in Clatsop county in order to encourage the use of the agricultural and forest resources of the county in such a way that the greatest possible returns may be secured, that a permanent source of revenue for local government may be assured, and that the lands of the county may be conserved for future use.

This report is issued to summarize conditions affecting the agriculture of the county and to list the recommendations of the land use committees, preliminary to developing a unified program for all agricultural agencies operating in the county.

Development of Land Use Planning, Procedure Used, and County Organization

The present land use activities began in February 1936 with the organization of an agricultural economics committee at the county agricultural economic conference. This committee considered land use problems and made recommendations. At the agricultural economic conference held in February 1938, this committee was termed the "land use committee". Since 1938 the committee has been working actively on the land use problems of the county and has given particular attention to the problem of establishing profitable use of cut-over timberlands. Among other activities, the committee advised with the Bureau of Agricultural Economics during the preparation of the land use study in Clatsop county made by that organization. In order to secure recommendations from the local people to use in forming a county land use policy, community organizations were set up in four communities in 1939-1940 by the county land use committee with the assistance of the Extension Service. At community meetings local committees were elected who made a study of their community agricultural problems and prepared community reports and land use maps. This material is the basis of this report and of the attached land use map.

The land use planning organization in Clatsop county is made up of the following committees:

Clatsop County Land Use Committee
Community Land Use Committees in four communities
- Astoria
- Nehalem Valley
- Columbia
- Seaside-Pacific

Introduction

Clatsop county is located in the extreme northwest corner of the state and is bounded on the north by the Columbia river and on the west by the Pacific ocean. General settlement of the county began about 1870.

Principal cities in the county include Astoria, which is the county seat, with a population of 10,389; Seaside 2,909; Warrenton 1,365; and Hammond 422.

The major industries of the county are fishing and lumbering.

Purpose

Land use planning has been developed in Clatsop county in order to encourage the use of the agricultural and forest resources of the county in such a way that the greatest possible returns may be secured, that a permanent source of revenue for local government may be assured, and that the lands of the county may be conserved for future use.

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Columbia
Seaside-Arch

PRESENT AGRICULTURAL SITUATION

Physical Features

Clatsop county has a land area of 524,800 acres according to the 1940 census. It is divided by the summit of the Coast range, which extends in a northerly and northeasterly direction through the county. The topography is very broken although elevation is not excessive at any point, varying from sea level to 3,266 feet at Saddle mountain. The eastern side of the Coast range in the county is drained by the Nehalem river, which flows in a southwesterly direction into Tillamook county and drains into the Pacific. West of the divide the principal rivers are the Necanicum, Lewis and Clark, Youngs, and Klaskanine. The upper reaches of the valley floors of these rivers are narrow but widen as they approach tidewater.

Climatic conditions are mild but vary somewhat between the coastal section and the interior of the county. There is greater range of temperatures and less moisture on the eastern side of the Coast range. The average growing season at Astoria, which is near the coast, is 272 days and 165 days at Jewell, which is located on the Nehalem river in the southeastern part of the county. Average precipitation at Astoria amounts to 77.14 inches and at Jewell 71.29 inches for the period 1920-1930. Average precipitation at Astoria for the past 73 years is 76.6 inches. The western side of the Coast range is characterized by heavy fogs and has more frequent summer rains than does the eastern side.

Soils of the County

Arable soils of Clatsop county are divided into six groups, as follows: 1/

1. Residual Soils

   Residual or hill soils are of the Melbourne series. They are dark brown in color, with a yellowish brown subsoil and have been formed from sandstone and shale. Drainage of these soils is good. In general they have limited crop adaptability. They are low in mineral fertility and are rather strongly acid in reaction. The soils are generally limited in use to pasture or to the growing of grain and vetch hay.

2. Old Valley-Filling Soils

   These soils, commonly called high benchlands, are made up principally of soils of the Willamette, Salkum, Grand Ronde, and Olney series. Drainage on the Willamette and Salkum series is good, but it is poor on the Grand Ronde and Olney series. The benchlands are generally better adapted to crop production than the hill soils.

1/ Unpublished Soil Survey of the Astoria Area

PRESENT AGRICULTURAL SITUATION

Physical Features

Clatsop county has a land area of 724,800 acres according to the 1940 census. It is divided by the summit of the Coast range, which extends in a northerly and northeasterly direction through the county. The topography is very broken although elevation is not excessive at any point, varying from sea level to 3,256 feet at Saddle mountain. The eastern side of the Coast range in the county is drained by the Nehalem river, which flows in a southwesterly direction into Tillamook county and drains into the Pacific. West of the divide the principal rivers are the Neacoxie, Lewis and Clark, Young, and Klaskanine. The upper reaches of the valley floors of these rivers are narrow but widen as they approach tidewater.

Climatic conditions are mild but vary somewhat between the coastal section and the interior of the county. There is greater range of temperatures and less moisture on the eastern side of the Coast range. The average growing season at Astoria, which is near the coast, is 272 days and 165 days at Jewell, which is located on the Nehalem river in the southeastern part of the county. Average precipitation at Astoria amounts to 77.14 inches and at Jewell 71.29 inches for the period 1920-1930. Average precipitation at Astoria for the past 72 years is 76.6 inches. The western side of the Coast range is characterized by heavy fogs and has more frequent summer rains than does the eastern side.

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1/ Unpublished Soil Survey of the Astoria Area

3. Recent Alluvial Soils

The stream bottom soils are principally made up of the Chehalis, Jewell, Sauvie, and Wapato series. Chehalis is a rich brown soil with a brown subsoil and has good drainage. The soils of the Jewell series are brown to light greyish brown in color, with a yellowish brown subsoil that is mottled in appearance. These soils are also well drained. The Sauvie series is made up of greyish brown soils, high in organic matter, on a mottled fibrous subsoil. Wapato soils are dark brown in color on mottled greyish brown subsoil and have poor drainage. The Chehalis, Jewell, and Sauvie series are productive soils adapted to a wide range of crops.

4. Marine Soils

Marine soils, or tideflats, are made up of soils in the Clatsop series and are brownish grey to grey in color. They are high in organic matter and have a grey mottled, heavy subsoil. The drainage of these soils is poor, due to the heavy textured subsoil and a high water table. However, they are highly productive when adequately drained and diked. They make up a large part of the agricultural land of the western part of the county.

5. Wind-Laid Soils

The more recent soils of this type include the Westport series, which is grey to greyish black on grey beach sand. They are low in organic matter and have rapid drainage. Older wind-laid soils are principally of the Hammond series, which is composed of dark greyish black soils on brown fine sand, with grey beach sand in the deeper horizon. Drainage of these soils is excessive. The wind-laid soils are located along the coastline and are used to a very limited extent for truck and bulb crop production or pastures.

6. Organic Soils

Organic or peat soils all require artificial drainage and are represented in the county by the Delmoor, Brallier, and Brownsmead series. Soils of the Delmoor series consist largely of sphagnum moss of raw to moderately raw fine fibrous material. They are of a straw to dark straw color. Most of the cranberry acreage in the county is on soils of this series. The Brallier series is composed of brown peat soils high in moss and sedge, with the subsoil of similar material but moderately decomposed. The Brownsmead series is made up of soils brown in color, finely fibrous with a brown subsoil, and is found along the Columbia river in the vicinity of Brownsmead.

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Economic and Social Features

Population

Population figures taken from the census of 1930 and 1940 are shown as follows:

	1930	1940
Urban Population	10,349	13,291
Rural Population	10,775	11,406
Total	21,124	24,697

Farm population in 1930 was 2,773 and in 1935 was 3,398.

Present Land Use

Most of Clatsop county is either in forest or is cut-over or burned-over forest land. Nearly 65 percent of the total area is in forest of some type at the present time, and over one-fourth is a deforested area of which little use is being made. Only a small part of the county is devoted to agricultural production.

One of the major uses of the tillable area of the county is for pasture. According to the 1940 census there were 7,369 acres of plowable pasture. Hay crops are also of importance, amounting to 6,598 acres in 1939. For the same period there were only 602 acres of grain crops in the county. Grass seed production has increased in importance during the past few years. In 1940 there were an estimated 3,300 acres harvested for grass seed.

Present uses of land in the county are summarized in the following table:

Present Land Use - Clatsop County

	Acreage	Percentage of Total Area
Tillable land 1/	17,027	3.3
Other land in farms 2/	13,831	2.6
Nonrestocked cut-over and burned-over areas 3/	140,715	26.8
Forested areas 3/	337,660	64.3
Resort, urban, waste, etc. 4/	15,567	3.0
Total land area 5/	524,800	100.0

1/ Harvested and idle cropland, crop failure, plowable pasture; 1940 Census.
2/ Nonplowable pasture, barnyards, feed yards, etc.; 1940 Census.
3/ "Forest Statistics for Clatsop County, Oregon." U. S. Forest Service July 15, 1938.
4/ Secured by subtracting other uses from county total.
5/ 1940 Census.

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The total acreage in farms is 51,754 acres or 9.9 percent of the total land area of the county. Division of the acreage in farms is shown in the following table:

Land in Farms - Clatsop County 1/

	Acres
Cropland harvested	8,829
Idle or fallow land	672
Crop failure	157
Plowable pasture	7,369
Woodland in farms	20,896
All other land in farms	13,831
Total	51,754

Land Ownership

A summary of land ownership in the county is shown below:

Ownership	Acres
Private and misc. 2/	418,666
County 3/	97,000
State 4/	5,722
Federal 4/	3,412
Total	524,800

County ownership has been increasing rapidly with the acquisition of tax-delinquent deforested lands. As of March 1940, the county owned 97,000 acres of land, and during the current year it is expected that this acreage will be increased by about 10,000 acres.

Tenancy has decreased in the county since 1935 according to 1940 census figures. The proportion of tenancy in 1940 was 11.2 percent compared with 18.2 percent for the state of Oregon. Farm ownership for the years 1930, 1935, and 1940 is given in the following table:

	Number of Farms		
	1930	1935	1940
Full owners	521	683	559
Part owners	45	29	25
Tenants	114	143	74
Managers	14	2	3
Percentage of tenancy	16.4	16.7	11.2

1/ 1940 Census.
2/ Includes approximately 5,000 acres owned by municipalities and other governmental subdivisions.
3/ County Assessor, Clatsop county.
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Number of Farms

According to the census of 1940 there are 661 farms in Clatsop county. According to these figures there has been an unexpected decrease in the number of farms in the county. In 1935 there were 857 farms, and in 1930, 694 farms as shown by the census.

The average sized farm in 1940 was 78 acres, as compared with an average size of 62 acres in 1935 and 107 acres in 1930.

The number of farms according to size is shown in the following tabulation taken from the 1940 census:

Size of Farm - Acres	Number of Farms
Under 10	108
10 to 29	188
30 to 49	95
50 to 69	52
70 to 99	68
100 to 259	116
260 to 499	29
500 to 999	3
1,000 and over	2
Total	661

Many of the smaller farms are part-time units whose operators are employed off the farm at least part of the year.

Number of Livestock

Dairying is the most important agricultural enterprise in the county. Of the 661 farms in the county 559 keep cows for milk production. Commercial poultry production is important on many farms. Production of sheep and beef cattle is limited to a smaller number of farms but is increasing particularly in the Nehalem valley area. Numbers of livestock and poultry for Clatsop county are listed below. 1/

	1940	1935	1930
Horses	461	595	708
Milk Cows	4,346	4,277	4,679
Beef Cattle	667	-	477
Hogs	460	647	566
Sheep	842	109	1,037
Chickens	65,790	62,083	80,499

Public Improvements

Transportation in the county is provided by the Spokane, Portland, and Seattle Railroad, which extends from Seaside north to the Columbia river and then east up the Columbia to Portland. Water transportation is available

1/ 1940 Census

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1/ 1940 Census

on the Columbia river with port facilities for large ships located at Astoria, Warrenton, and at other points along the river.

Paved highways are located along the north and west sides of the county and through the county following the main settled areas. A section of the Wolf Creek highway from Portland to the coast extends through the southern part of the county. In addition, there are numerous county and forest roads serving both rural and urban areas.

There are 37 school districts in the county. Enrollment in public schools in 1937-38 was as follows: 2,859 in grade schools; 1,189 in high schools; with a total of 4,048. Outside the city of Astoria the total school enrollment amounted to 2,343.

In 1938, 83 percent of the farms in the county were served by electric lines.

COUNTY-WIDE AGRICULTURAL PROBLEMS

Taxation

Explanation of the Situation 1/

The taxable valuation of all property in Clatsop county has decreased materially during the past two decades. The greatest decline in assessed valuation has been in real property, although assessed valuation of personal and public utility property has also declined during more recent years. Assessed valuation of real property amounted to approximately 76.7 percent of the total assessed valuation of the county in 1938.

The taxable valuation and total full cash valuation of all lands in Clatsop county since 1910 are shown in the following table:

Year	Taxable Valuation	Percent of Taxable to Full Cash Value	Total Full Cash Valuation
1910	$ 9,522,324	33	$28,855,527
1915	20,595,027	58	35,508,667
1920	41,550,735	80	51,938,418
1925	38,608,030	78	49,497,474
1930	28,333,567	70	40,476,524
1935	18,404,117	61	30,170,683
1938	15,714,788	60	26,191,332

The decline in the assessed valuation of taxable property in the county can be accounted for to a large extent by the harvesting of timber resources and the resulting decline in valuation of timberlands. The high point of assessed valuation of timberlands occurred in 1923 when such lands in the county were assessed at $18,541,020, as compared with an assessed valuation of $4,491,611 in 1937. This is a decrease in the assessed valuation of timberlands of 75.8 percent.

1/ Data for this section of the report secured from 14th biennial report of the State Tax Commission.

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In 1938, 148,576 acres of forest lands in the county had been classified for reforestation, which was the largest acreage classified from any county in the state. Reforestation lands are not subject to an ad valorem tax since they are charged an annual tax of 5 cents per acre, together with a yield tax of 12½ percent of the value of any forest products removed from the land. These lands also pay a fire patrol tax as do other forest lands in the county.

The assessed valuation of tillable lands in 1938 averaged $55.86 per acre, for non-tillable land, $8.26 per acre, and for timberland, $23.99 per acre.

Total tax delinquency of Clatsop county as of December 31, 1937, amounted to $3,337,312, which was over three times as large as the tax levy for 1938. Taxes which were delinquent on the rolls of 1930 and prior years amounted to $1,441,715. The amount of tax delinquency more than doubled from 1931 to December 31, 1937. Delinquent taxes for this period amounted to $1,895,597.

In 1938 the public debt of Clatsop county amounted to $6,949,067, which was 44 percent of the taxable valuation of property in the county. The public debt summarized as of 1938 is as follows: 1/

Incorporated cities	$3,744,461
School districts	210,711
Drainage districts	3,095
Water districts	3,250
Port districts	2,987,550

The tax levy for 1940 for the county was $993,552.45, the lowest since 1917, as compared with the levy for 1924, of $2,310,202.58, the highest levy in the history of the county.

Problems and Recommendations

Taxes have increased for the year 1941 by approximately 5 percent for the Port of Astoria and by a lesser percentage for fire patrol and county roads. This increase, as explained in the preceding section, is due to the continual liquidation of timber resources of the county, with a resulting loss of tax revenue from harvested timberlands.

To replace this lost revenue it is considered necessary to establish either a forest cover or a grass cover on these cut-over or burned-over lands. It is recommended that a public policy be promulgated by the county court to be used as a guide in dealing with the use of logged-off, tax-reverted lands. The classification of these lands as to their best use is given elsewhere in this report.

1/ Basic Data for Clatsop County Compiled by Bureau of Agricultural Economics, Corvallis, Oregon

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The assessed valuation of tillable lands in 1938 averaged $35.86 per acre, for non-tillable land, $8.25 per acre, and for timberland, $22.99 per acre.

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Taxes have increased for the year 1941 by approximately 5 percent for the Port of Astoria and by a lesser percentage for fire patrol and county roads. This increase, as explained in the preceding section, is due to the continual liquidation of timber resources of the county, with a resulting loss of tax revenue from harvested timberlands.

To replace this lost revenue it is considered necessary to establish either a forest cover or a grass cover on those cut-over or burned-over lands. It is recommended that a public policy be promulgated by the county court to be used as a guide in dealing with the use of logged-off, tax-reverted lands. The classification of these lands as to their best use is given elsewhere in this report.

1/ Basic data for Clatsop County compiled by Bureau of Agricultural Economics, Corvallis, Oregon.

Repeal of the reforestation act is recommended, based upon the following objections:

1. It is considered a tax and not a reforestation law.

2. Provisions may or may not apply to lands growing a second crop of timber.

3. It is considered a method of "cold storaging" land that relieves the owner of hazards of taxation and assessment, and for this reason is considered class legislation.

4. Returns to the public from reforestation lands are too small in comparison to the requirements imposed on the owners of these lands and the fixed costs to them. As a result, it is immaterial to the county whether these lands remain in private hands or revert to the public.

5. Much land has been classified as reforestation land that the owners never intended to carry as forest land.

6. The revenue to the county from lands classified for reforestation is so small that if large areas are classified it will be extremely difficult for the local government to function satisfactorily without endangering the property of other taxpayers.

7. The determination of the value of timber on reforestation lands is on a stumpage basis, which in effect removes it from competitive bidding.

8. It is felt that under the present law only the best land classified will be carried through to harvest, while the rest of the land will revert to public ownership.

9. Owners of reforestation lands are not required to make any improvements on the land. Their only requirement is to pay the annual fee of five cents per acre.

Farm Credit

Explanation of the Situation

Credit is available to farms in Clatsop county from two banks, one in Astoria and the other in Seaside; from the National Farm Loan Association with headquarters at Tillamook; from the Farm Security Administration at Astoria; and from the Willamette Valley Production Credit Association with offices at Salem.

The banks make loans to farmers on chattel mortgages and also make loans secured by orders on cooperative associations. Livestock and crop loans can be secured from the banks for periods as long as one year, and real estate loans are limited to a period of eight years and can be secured for as high as 50 percent of the value of the property.

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The loans made by the Willamette Valley Production Credit Association in Clatsop county have been rather limited in the past. This organization now has four loans in force in the county, with a total of $6,441.23 loaned.

The Farm Security Administration loans to farmers whose credit opportunities from other sources are limited or restricted. These loans are made on chattels or recoverable goods for a period of as long as five years. Twenty-two farmers have loans at the present time from the Farm Security Administration, amounting to $22,173.00.

Emergency seed and feed loans are available on a seasonal basis for the purchase of seed and livestock feed. These loans are made by the Farm Credit Administration. Applications are taken at the county agent's office. An average of approximately five farmers secure loans annually, amounting to approximately $1,500.

Since the organization of the Federal Land Bank in 1917, the Bank and the Land Bank Commissioner have made a total of 208 loans amounting to $622,100 in Clatsop county. At the present time 134 of these loans are outstanding, totaling $425,600. Fifteen loans, amounting to $48,600 have been acquired by the bank, all of which were made prior to 1933. Fifty-nine borrowers have paid off their loans, which amounted to $147,900.

From 1917 to 1939 loans by the Federal Land Bank and Land Bank Commissioner were made on 19,813 acres of farm land, which included 6,476 acres of cultivated lands. This amounts to 38 percent of the present tillable acreage in the county. Loan experience of the Federal Land Bank is summarized in the table on the following page.

Problems and Recommendations

With the development of the range livestock industry on cut-over lands in the county, particularly in the Nehalem section, a need for adequate financing has arisen. The proper development of these areas at the present time is handicapped by a lack of financing. Experimental results secured at the Northrup Creek Experimental Area for the past several years have shown that pastures can be established with a high carrying capacity on logged-off lands, and thus far have indicated that development of the cut-over lands for grazing in this community is sound.

It is recommended that particularly the Federal Land Bank and local banks make loans for the purchase and development into pastures of cut-over lands which have been classified as suitable for range use, and that the Production Credit Association make adequate loans to assist in the stocking of these areas.

The present financing for the improvement and enlargement of dairy units is not considered adequate. It is recommended that credit agencies provide financing, particularly in cases where economic units can be developed.

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Loan Experience of the Federal Land Bank
Clatsop County
From Organization to December 31, 1939

(All amounts are in hundreds of dollars)

Years	Type of Loan	Loans Closed No.	Loans Closed Amt.	Loans Outstanding No.	Loans Outstanding Amt.	Loans Acquired No.	Loans Acquired Amt.	Loans Paid Off No.	Loans Paid Off Amt.	Total Acres	Cult. Acres
Federal Land Bank											
1917-23	Truck 1/	8	133	4	52	2	38	2	43	231	74
	Dairy	81	2,735	46	1,713	6	263	29	759	7,484	2,405
	Poultry	2	17	1	8	0	0	1	9	102	14
	Livestock	2	60	1	45	0	0	1	15	420	70
	General	35	718	17	325	5	135	13	258	2,535	563
	Total	128	3,663	69	2,143	13	436	46	1,084	10,772	3,126
1924-32	Dairy	21	1,190	14	870	1	32	6	288	2,492	1,014
	Poultry	1	15	1	15	0	0	0	0		9
	General	8	178	6	145	1	18	1	15		154
	Total	30	1,383	21	1,030	2	50	7	303	2,492	1,177
1933-39	Dairy	16	572	16	572	0	0	0	0	2,072	879
	Poultry	2	22	1	6	0	0	1	16	418	93
	Total	18	594	17	578	0	0	1	16	2,490	972
Land Bank Commissioner											
1933-39	Truck 1/	1	8	0	0	0	0	1	8	9	9
	Dairy	23	450	20	395	0	0	3	55	3,214	1,024
	Poultry	1	10	1	10	0	0	0	0	19	7
	General	6	83	5	70	0	0	1	13	789	144
	Specialty	1	30	1	30	0	0	0	0	28	17
	Total	32	581	27	505	0	0	5	76	4,059	1,201
Grand Total		208	6,221	134	4,256	15	486	59	1,479	19,813	6,476

1/ Truck and/or berry

Loan Experience of the Federal Land Bank
Clatsop County
From Organization to December 31, 1939

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Forestry

Explanation of the Situation

Problems of the forest area are considered as county-wide problems since all communities contain tracts of timber, and problems of the forest industry affect the entire population either directly or indirectly.

Forest lands occupy the largest single area in the county. Approximately 335,767 acres have been designated by the land use committees as the area in the county that is primarily suited for permanent forest production, although later developments may change this. However, in the areas classified for agricultural use there is a considerable acreage of timber intermixed with pasture or cultivated lands. For this reason the following description of the forest lands of the county will apply to timber stands located in areas classified for uses other than forestry, as well as for permanent forest areas.

The forest lands of the county are divided into two broad groups; 1/ those dominated by Douglas fir and those predominantly of pulp wood species. The Douglas fir species are mostly in the eastern part of the county and occupy nearly 112,000 acres, of which 45 percent supported stands of saw timber type in 1937. The types dominated by the pulp wood species are distributed over 214,000 acres in the western and northern parts of the county. This area was about equally divided between types of saw timber size and types of smaller size in 1937. Further classification of the forested lands of the county is shown in the following table:

Forest Types by Areas 1/

	Acres
Douglas fir	111,570
Sitka spruce	23,515
Western hemlock	183,075
Western red cedar	1,455
Fir - Mountain hemlock	7,250
Lodgepole pine	105
Hardwoods	9,830
Noncommercial rocky areas	860
Total	337,660

The volume of trees 16 inches and more in d.b.h. was estimated at 7.9 billion board feet, November 1, 1937. 1/

A classification of the forest lands of Clatsop county shows that the county is above the average of the Douglas fir region in its ability to grow timber crops. This is particularly true of the western part of the county in which the pulp wood species predominate and where the forest lands are considered as highly productive for timber crops.

1/ "Forest Statistics for Clatsop County, Oregon." U. S. Forest Service, July 15, 1938.

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The timberlands have been divided into saw timber types, immature forest types, and deforested areas, which are described as follows:

1. Saw Timber Types

As of 1937 there were approximately 155,000 acres of coniferous saw timber types in Clatsop county. This amounted to approximately 46 percent of the timbered area in the county and was divided as follows: 1/

50,000 acres Douglas fir type
80,000 acres Western hemlock type
17,000 acres Sitka spruce
7,000 acres balsam fir type
1,500 acres Western red cedar type

There are approximately 10,000 acres of saw timber of hardwood types which contain about 53 million board feet. Seventy-three percent of this amount is red alder and 27 percent big-leaf maple. 1/

2. Immature Forest Types

As of 1937, there were 171,500 acres of immature forest types in the county. One hundred three thousand, five hundred acres consisted of Western hemlock types, 61,500 acres of Douglas fir types, and 6,500 acres of Sitka spruce types. Fifty-five percent of the immature types were over 6 inches and 45 percent were under 6 inches d.b.h. 1/

3. Deforested Areas

One hundred forty thousand, seven hundred fifteen acres were classified as nonrestocked burned-over or cut-over areas in 1937. 1/ Of this acreage, approximately 87,000 2/ acres are located in the Nehalem community and have been classed by the committee as predominantly suited for grazing development.

Clatsop county has been a leading county in the state in the production of logs. This has been due to the nearness of the timberlands in the county to tidewater, cheap transportation, and the fine quality of timber produced in the county. From 1925-1938 the average annual timber depletion was slightly over 400 million board feet, which made Clatsop county out-rank all other counties in the state in volume of timber production. Since 1930 the trend in logging has been toward the use of lighter equipment, including the use of tractors for yarding and the use of trucks for transportation. This change in methods is causing changes in production. Instead of following the practice of clean cutting, which is generally used, some operators are logging selectively. Stands being logged in this manner mostly contain scattered high value trees with an understory of thrifty, well-stocked second growth.

1/ "Forest Statistics for Clatsop County, Oregon." U. S. Forest Service, July 15, 1938.

2/ "An Area Plan for Land Use, Clatsop County, Oregon." Vernon W. Baker, Assistant Agricultural Economist, Bureau of Agricultural Economics, U. S. Department of Agriculture. 1940

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There are approximately 10,000 acres of saw timber of hardwood types which contain about 33 million board feet. Seventy-three percent of this amount is red alder and 27 percent is big-leaf maple. 1/

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Based on the average logging depletion of approximately 400 million board feet for the period 1925-38, and making allowance for annual growth, it is estimated that by 1945 the total volume of timber in the county will have dropped to about 5 billion board feet. If the Douglas fir stands continue to be depleted at the rate of 300 million board feet a year, by 1945 they will be completely logged except for a small board foot volume in second growth stands. Using the average annual cut for the period 1935-38 of approximately 160 million board feet of the pulp wood species, the total volume of timber that will be in the county at the end of the next three decades is estimated as follows: 1/

1948 - 4.7 billion board feet
1958 - 3.6 billion board feet
1968 - 2.7 billion board feet

Estimates have been made by the Pacific Northwest Forest and Range Experiment Station of a potential annual growth on 324,070 acres considered as primarily suited to forest use. 1/ The estimated potential annual growth that could be obtained through intensive management practices on this acreage amounts to 177,889,000 board feet annually. This potential annual growth is about 45 percent of the annual average log depletion in the county for the period 1925-38, but is slightly larger than the estimated annual cut for the county following completion of logging of the remaining stands of merchantable Douglas fir.

Problems and Recommendations

The areas in the county which are considered as primarily suited to forest production by the committee amount to approximately 335,767 acres. In classifying these areas for forestry, consideration has been given to the necessity of securing immediate revenue for county government. Since other uses, principally grazing on adapted lands, will make quicker returns, the total acreage dedicated to forestry has been reduced from the acreage originally producing timber.

Problems affecting the forest lands of the county are discussed as follows:

1. Management of Merchantable Timber

No recommendations are made for the management of the merchantable timber that still remains in the county. It is believed that these holdings will be liquidated within the next few years, regardless of what action may be taken by the public.

2. Management of Logged-Off Lands

The major forest problem and the most important problem affecting the welfare of the county involves the use of lands from which the merchantable timber has been removed. The future use of these lands affects taxation, business, and employment in the county. In the past there has been no policy for the management of logged-off

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Action that should be taken regarding the management of logged-off lands is discussed as follows:

a. Reforestation

Logged-off land in the county which has been classified for the production of timber crops consists of land which now has no forest cover, with the exception of some hardwoods, and areas where reforestation has taken place naturally. The logged-off lands which have no forest cover have been burned-over a number of times and are covered with fern, brush, and weeds, which constitute a serious fire hazard. In order to develop timber stands on these lands it will be necessary for seed trees to be planted, since it is the opinion of the committee that only natural reforestation is feasible under present conditions. It is recommended that a research project be started by the John Jacob Astor Experiment Station in order to determine what is required to convert these lands to economic use. Action taken by the State Forestry Department in conducting experiments on restocking of this type of land with trees, on land secured from the county, is commended

The major portions of the lands which have been classified for the production of a second crop of timber contain a good second growth at the present time. The areas which contain a stand of merchantable timber that are classified for forest production should have seed trees left standing in sufficient number that a new forest growth can be assured, and adequate protection should be given to these seed trees at the time the slash is burned to prevent their destruction.

Because of the danger from fire it now appears that blocks of land from 5,000 to 8,000 acres are as large as should be permitted to go into solid stands of timber. It is recommended that these areas be surrounded by open grazing land in order to reduce the fire hazard.

It is the opinion of the committee that it is very doubtful if reforestation will be carried on to any great extent by private enterprise for the reason that anyone engaged in the growing of timber would require a period of 50 to 150 years in order to obtain a return on the investment. A possible exception may be the pulp companies who can harvest a crop every 50 or 60 years. For this reason it is concluded that if reforestation is to be carried on effectively, it will have to be done by some public agency. The objection to reforestation by either the state or federal government is that control of the forest lands is outside the county.

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It is suggested that one approach to the problem of reforestation would be a cooperative arrangement between the federal and state forest agencies and the county, although it would require an Act of Congress to permit federal cooperation. Under such an agreement, each would assume the administration of certain areas agreed upon at the time the program was undertaken. It is felt that if such a cooperative program is undertaken, the county court should be the organization that would determine what lands should be administered by the different agencies. The county should make an effort to determine what their costs would be for such an undertaking, in order to determine whether the county court would be in a position to carry on a program of reforestation on its lands.

It is believed that the present laws permitting the formation of county forests are too indefinite and incomplete. The ownership of tax-reverted lands set aside for the growing of timber is felt to be indefinite under the present law. Changes are needed to allow returns from forest lands owned by the county to accrue directly to the general county fund. Provisions in the law should also be made requiring public hearings at the time county forests are formed.

It is felt that lands suitable for forestry should be classified by the County Land Classification Committee as provided for in Chapter 381 of the Oregon Laws of 1937 as forest land.

b. Other Uses for Logged-Off Lands

It is felt that it would be impossible to maintain financially a satisfactory county government on its present basis if substantially all of the logged-off land is again set aside for timber growing. In order to obtain revenue at an earlier date and in larger quantities, a part of this land will have to be used for other purposes. The one project that gives the most promise of meeting these needs is the seeding of grasses and clovers for grazing purposes. Grazing development is discussed in another section of the report.

3. Timber Processing

There is a need for the development of plants in the county for the processing of pulp species of timber. Every effort should be made to secure such plants so that the raw material produced in the county can be processed locally, which will give a better value to the timber that is being grown, and will prevent the pulp species in the county from becoming a cheap reservoir to supply processing plants in other sections.

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Note: The forest areas are colored green on the land use map.

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Note: The forest areas are colored green on the land use map.

LAND USE ADJUSTMENTS

KLAMATH COUNTY, OREGON

(24)

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It is felt that lands suitable for forestry should be classified by the County Land Classification Committee as provided for in Chapter 241 of the Oregon Laws of 1937 as forest land.

b. Other uses for logged-off lands

It is felt that it would be impossible to maintain financially a satisfactory county government on the present basis if substantially all of the logged-off land is again set aside for timber growing. In order to obtain revenue at an earlier date and in larger quantities, a part of the land will have to be used for other purposes. The one project that gives the most promise of meeting these needs is the seeding of grasses and clovers for grazing purposes. Grazing development is discussed in another section of the report.

3. Timber Processing

There is a need for the development of plants in the county for the processing of pulp species of timber. Every effort should be made to secure such plants so that the raw material produced in the county can be processed locally, which will give a better value to the timber that is being grown, and will prevent the pulp species in the county from becoming a cheap reservoir to supply processing plants in other counties.

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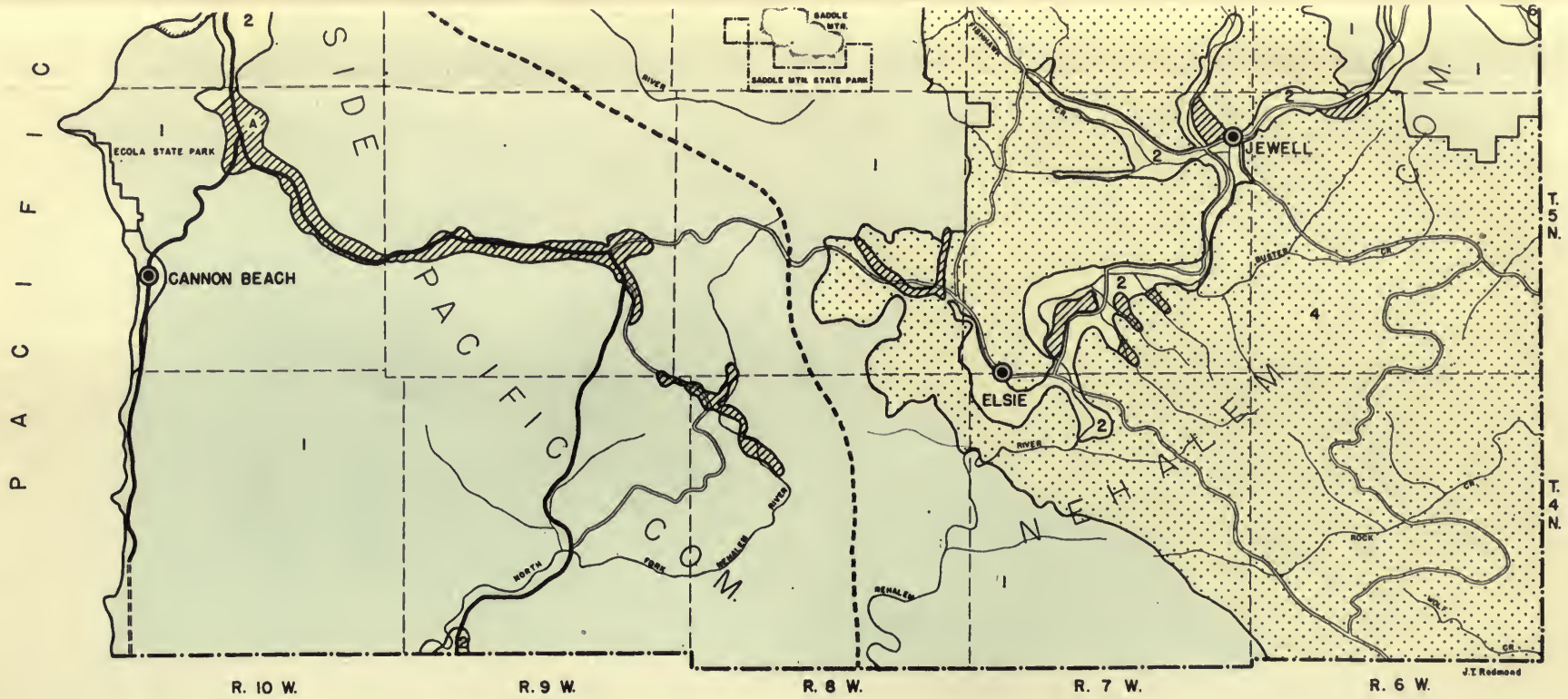
LAND USE ADJUSTMENTS

CLATSOP COUNTY, OREGON

1941

CLATSOP COUNTY LAND USE COMMITTEE
In cooperation with
OREGON STATE COLLEGE
and
BUREAU OF AGRICULTURAL ECONOMICS

Drafted on W.P.A. Project W.P. 3061 P.S. O.P. 65-1-94-66



1	FOREST AREAS
2	FARM LAND, NON-IRRIGATED (Minor adjustments if any needed)
3	FARM LAND, NON-IRRIGATED (Major adjustments needed)
4	GRAZING LAND (Major adjustments needed)
5	AREAS THAT SHOULD BE RETIRED FROM AGRICULTURE
6	NOT CLASSIFIED (Includes-urban, reservations, parks, recreation, ect.)

COLOR REPRODUCTION BY BUREAU OF AGRICULTURAL ECONOMICS

AREA CLASSIFICATIONS AND RECOMMENDATIONS

Area classification in Clatsop county has been based upon the outline, "Oregon Mapping Procedure for Land Use Adjustments", which was prepared by the Land Grant College-Bureau of Agricultural Economics Committee, December 5, 1939, and revised February 23, 1940. This outline is a modification of work outline No. 1, issued by the Washington office of the Bureau of Agricultural Economics and provides for a more detailed land classification. The classification divides agricultural land from forest areas and cultivated land from grazing land.

Agricultural areas have been classified by the community committees on the basis of whether they are in need of minor adjustment, major adjustment, or if they should be retired from agricultural use. Minor adjustments are those which seem desirable, but may not be necessary to insure a permanent agriculture. Major adjustments are those that seem necessary to maintain desirable productivity of the soil or to insure stability of the farm home. One-third or more of an area was required to be in need of major adjustment before being given that classification. Problems of the forest area of the county are discussed under the section on county-wide problems.

Astoria Community

The Astoria community extends from the city of Astoria in a semicircular radius of about 10 miles. The Youngs river valley, the Lewis and Clark, and John Day river valleys are located in the community.

I. Agricultural Areas Needing Major Adjustments

A. Subarea 3-A (Colored single-hatch yellow)

1. Description

The subarea is located along the Lewis and Clark and Youngs rivers and their tributaries, and consists of approximately 12,655 acres. For the most part, farms in the subarea are the larger farms in the county, which are engaged principally in dairying and in the production of grass seeds. The smaller farms are engaged in poultry production and in the production of berries and vegetables.

2. Problems and Recommendations

a. Drainage

Drainage is considered by the committee to be a major problem of the area. At the present time for most of the area the rebuilding of dikes, which has been completed, has secured these lands from overflow from the bay and the river. Interior drainage must be effected to put them in condition to be used to their maximum capacity and to make possible other improved practices. Interior drainage is a problem affecting the major part of the subarea, and is largely an individual farm problem.

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Astoria Community

The Astoria community extends from the city of Astoria in a semi-circular radius of about 10 miles. The Young's river valley, the Lewis and Clark, and John Day river valleys are located in the community.

I. Agricultural Areas Needing Major Adjustments

A. Subarea 3-A (Colored single-hatch yellow)

1. Description

The subarea is located along the Lewis and Clark and Young's rivers and their tributaries, and consists of approximately 12,655 acres. For the most part, farms in the subarea are the larger farms in the county, which are engaged principally in dairying and in the production of grass seeds. The smaller farms are engaged in poultry production and in the production of berries and vegetables.

2. Problems and Recommendations

a. Drainage

Drainage is considered by the committee to be a major problem of the area. At the present time for most of the area the rejuvenating of ditches, which has been completed, has secured these lands from overflow from the bay and the river. Interior drainage must be effected to put them in condition to be used to their maximum capacity and to make possible other improved practices. Interior drainage is a problem affecting the major part of the subarea, and is largely an individual farm problem.

It is recommended that assistance be provided by the Extension Service to farmers to assist them in the planning and surveying of individual drainage systems. It is also recommended that payments be provided in the AAA program for the establishment of individual drainage systems.

b. Pasture Improvement

Since the dairy industry, which is the major agricultural enterprise of the community, is dependent to a great extent upon pastures, the improvement and maintenance of pastures is felt to be an important problem. Rotation of grazing on farm pastures is felt to be a desirable practice. A pasture mixture which is currently recommended for tidelands, of which this subarea consists, is as follows:

	Lbs. per Acre
English ryegrass	4
Tall fescue	4
Orchard grass	2
Meadow foxtail	2
Lotus major	2
White clover	2
Creeping timothy	1

c. Land Clearing

Since the quality of the land in the subarea is high, clearing of additional land is recommended. This land, when cleared, will add to the usable acreage of established farms and in some instances will provide new farm units.

The use of bulldozers and other heavy equipment has proved to be the most economical method of land clearing and is recommended to be used in this subarea.

d. Soil Fertility

Maintaining soil fertility and the use of a crop rotation system are felt to be important by the committee, especially where the land is not in sod or perennial crops and is cultivated either continuously or during frequent periods. In some instances, restoration of soil fertility is necessary.

A recommended crop rotation for the subarea would be two years of cultivated crops and at least four years in sod. In addition to proper rotations, the conservation and use of manure and the use of lime and phosphates are recommended in order to maintain fertility. An increase in use of liquid manure tanks is considered to be desirable.

It is recommended that assistance be provided by the Extension Service to farmers to assist them in the planning and surveying of individual drainage systems. It is also recommended that payments be provided in the AAA program for the establishment of individual drainage systems.

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	Lbs. per Acre
English ryegrass	4
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Orchard grass	2
Meadow foxtail	2
Lotus major	2
White clover	2
Creeping bentgrass	1

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A recommended crop rotation for the subarea would be two years of cultivated crops and at least four years in sod. In addition to proper rotations, the conservation and use of manure and the use of lime and phosphates are recommended in order to maintain fertility. An increase in use of liquid manure tanks is considered to be desirable.

e. Irrigation

Irrigation of dairy pastures and some cultivated crops is a recommended practice and should be increased. Irrigation is needed in the summer and early fall, during the time that precipitation is negligible.

Irrigation by the sprinkler method is considered to be the principal method that is adapted to this subarea. However, in a few instances it will be possible to subirrigate through the closing of tidegates.

B. Subarea 3-B (Colored single-hatch yellow)

1. Description

This subarea consists of 856 acres, which are principally made up of bench and hill soils. Part of the area is taken up by farmers for homesites for the dairy farms located in Subarea 3-A, and in addition there are some suburban homes in this section. There are also a number of part-time farm units that are of an uneconomic size, and it is for this reason that the area is classified as being in need of major adjustment.

2. Problems and Recommendations

a. Size of Farm Unit

The part-time farms in the subarea are of so small a size that they cannot produce an income adequate to support an average family. The operators of these units are employed in logging camps, lumber mills, or in other industries. In most instances the size of unit is adequate at the present time because of the available industrial employment. In the event that industrial employment, particularly in the lumber industry, declines, it will be necessary to consolidate these units into larger farms of a size that will support the average family.

Much of the uncleared land in the subarea is of such a type that it is not suitable for farming. The clearing of this land should be discouraged for the reason that the cost will either equal or exceed the value of the land.

The minimum size farm unit for full-time employment recommended for this subarea would be a poultry unit of at least 20 acres, with 2,000 birds, or a dairy unit with a minimum of 60 cultivated acres.

b. Soil Fertility

Since the soils are natively not as fertile as the bottom lands, attention should be given to maintaining and improving soil fertility by the conservation and use of manure and the use of phosphates and lime.

e. Irrigation

Irrigation of dairy pastures and some cultivated crops is a recommended practice and should be increased. Irrigation is needed in the summer and early fall, during the time that precipitation is negligible.

Irrigation by the sprinkler method is considered to be the principal method that is adapted to this subarea. However, in a few instances it will be possible to subirrigate through the clearing of ditches.

B. Subarea 3-B (Colored single-batch yellow)

1. Description

This subarea consists of 856 acres, which are principally made up of beach and hill soils. Part of the area is taken up by farmers for homesites for the dairy farms located in Subarea 3-A, and in addition there are some suburban homes in this section. There are also a number of part-time farm units that are of an uneconomic size, and it is for this reason that the area is classified as being in need of major adjustment.

2. Problems and Recommendations

a. Size of farm unit

The part-time farms in the subarea are of so small a size that they cannot produce an income adequate to support an average family. The operators of these units are employed in logging camps, lumber mills, or in other industries. In most instances the size of unit is adequate at the present time because of the available industrial employment. In the event that industrial employment, particularly in the lumber industry, declines, it will be necessary to consolidate these units into larger farms of a size that will support the average family.

Much of the uncleared land in the subarea is of such a type that it is not suitable for farming. The clearing of this land should be discouraged for the reason that the cost will either equal or exceed the value of the land.

The minimum size farm unit for full-time employment recommended for this subarea would be a poultry unit of at least 20 acres, with 2,000 birds, or a dairy unit with a minimum of 50 cultivated acres.

b. Soil Fertility

Since the soils are relatively not as fertile as the bottom lands, attention should be given to maintaining and improving soil fertility by the conservation and use of manure and the use of phosphates and lime.

c. Drainage

There is a problem of drainage on some of the farms in this subarea. This is an individual problem in all instances and would not involve community-wide action. Methods of securing adequate drainage that are recommended for Subarea 3-A would apply in this subarea as well.

d. Pasture Improvement

There is an apparent need for pasture improvement, particularly on some of the larger farms in the subarea. Use of rotation methods of grazing is recommended. The following pasture mixture, suitable for hill and benchlands, is currently recommended by the Extension Service and Experiment Station:

	Lbs. per Acre
English ryegrass	4
Tall fescue	4
Orchard grass	2
Subterranean clover	2
Domestic white clover	2

Columbia Community

This division of the county, for the land use planning program, consists of the Svensen, Knappa, Brownsmead, and Westport communities, and the Columbia river islands. The area extends from a point on the Columbia river halfway between the John Day river and Svensen up the Columbia to the county line.

I. Agricultural Areas Needing Minor Adjustments

A. Subarea 2 and 2-A (Colored yellow)

1. Description

This subarea consists of tideland bottoms along the Columbia river amounting to approximately 4,410 acres. Dairying is the principal agricultural enterprise in the community, although there is some vegetable production near Brownsmead and a limited amount of grass seed production on farms scattered throughout the subarea.

2. Problems and Recommendations

a. Soil Fertility

The maintenance of soil fertility is a minor problem of the subarea. It is recommended by the committee that land which is used continuously or frequently for cultivated crops should have its fertility maintained by the use of manure and green manure crops. A rotation of two years in

c. Drainage

There is a problem of drainage in some of the farms in this subarea. This is an individual problem in all instances and would not involve community-wide action. Methods of securing adequate drainage that are recommended for Subarea 3-A would apply in this subarea as well.

d. Pasture Improvement

There is an apparent need for pasture improvement, particularly on some of the larger farms in the subarea. Use of rotation methods of grazing is recommended. The following pasture mixture, suitable for hill and bench-lands, is currently recommended by the Extension Service and Experiment Station:

	Lbs. per Acre
English ryegrass	4
Tall fescue	4
Orchard grass	2
Subterranean clover	2
Domestic white clover	2

Columbia County

This division of the county, for the land use planning program, consists of the Scappoose, Knappa, Brownsmead, and Warren communities, and the Columbia river islands. The area extends from a point on the Columbia river railway between the John Day river and Scappoose up the Columbia to the county line.

I. Agricultural areas Needing Minor adjustments

A. Subarea 2 and 2-A (Diked yellow)

1. Description

This subarea consists of tideland bottoms along the Columbia river amounting to approximately 4,100 acres. Dairying is the principal agricultural enterprise in the community, although there is some vegetable production near Brownsmead and a limited amount of grass seed production on farms scattered throughout the subarea.

2. Problems and Recommendations

a. Soil Fertility

The maintenance of soil fertility is a minor problem of the subarea. It is recommended by the committee that land which is used continuously or frequently for cultivated crops should have its fertility maintained by the use of manure and green manure crops. A rotation of two years in

cultivation and at least four years in grass is suggested for farms in this area. Where vegetables are grown, the land will benefit by liberal applications of barnyard manure, and where manure is not plentiful, fall planted green manure crops can be grown to protect the soil from winter leaching and to help maintain fertility.

b. Irrigation

Due to deficiencies in rainfall during the summer and early fall months, a large part of the subarea could benefit from irrigation during that time of the year, except where there is more or less subirrigation. Because of land leveling costs for other methods of irrigation, the sprinkler system is considered to be the best adapted to the local conditions.

c. Size of Farm Unit

The size of farm unit that is recommended by the committee as the minimum size required to support the average family consists of 20 acres of cleared tideland; however, from 25 to 30 acres is considered a more desirable size.

d. Pasture Improvement

Pastures are important to dairying, which is the major enterprise in the subarea. For this reason their improvement is considered to be necessary. A pasture mixture that is currently recommended for soils of the type found in this subarea is as follows:

	Lbs. per Acre
English ryegrass	4
Tall fescue	4
Orchard grass	2
Meadow foxtail	2
Lotus major	2
White clover	2
Creeping timothy	1

B. Subarea 2-B (Colored yellow)

1. Description

This subarea, which consists of the hill and benchland located immediately above the tideland flats along the Columbia River highway near Knappa and Svensen, is approximately 10,050 acres in size. It is composed of hill and benchland containing a considerable portion of uncleared logged-off land intermixed with the cultivated fields. Poultry production is the principal agricultural enterprise in the subarea, and it is in this section that the larger portion of the Clatsop county poultry industry is located.

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	Lbs. per Acre
English ryegrass	4
Tall fescue	4
Orchard grass	2
Meadow foxtail	2
Lotus major	2
White clover	2
Creeping timothy	1

B. Subarea 2-B (Colored yellow)

1. Description

This subarea, which consists of the hill and benchland located immediately above the tideland flats along the Columbia River highway near Knappa and Svensen, is approximately 10,250 acres in size. It is composed of hill and benchland containing a considerable portion of uncleared logged-off land interwoven with the cultivated fields. Poultry production is the principal agricultural enterprise in the subarea, and it is in this section that the larger portion of the Clatsop county poultry industry is located.

Soils of the subarea are composed of the Willamette, Salkum, and Melbourne series. These soils are not considered as natively fertile as the bottom lands of the community.

There are many self-sustaining poultry farms in the subarea, and it is for this reason that it is classified as needing only minor agricultural adjustments. Also located in the subarea are some part-time farms operated by loggers, fishermen, and people employed in other industries.

2. Problems and Recommendations

a. Soil Fertility

The soils in this area are naturally not too fertile, and any use of them has to be accompanied by practices for improving, or at least maintaining, the soil fertility if farming can be successfully continued. All farms should include some type of livestock enterprise, with careful conservation and use of farm manure, together with the use of phosphate and lime.

b. Pasture Improvement

Improvement of pasture, particularly on the larger farms in the subarea, is needed. The seeding of pasture to mixtures that are currently recommended by the Extension Service that have been found to be adapted to the upland soils of the county is recommended.

c. Size of Farm Unit

With the exception of the commercial poultry farms and some dairy units, the remaining farms in this subarea are on a part-time basis. At the present time, when it is possible for the operators of these small units to earn part of their living by employment in the lumber or fishing industries, the size of unit does not offer a problem. However, in the future if part-time employment decreases as it is expected to do, particularly in the logging industry, these part-time units will present a problem.

It may be necessary to enlarge small-size units by consolidating two or more farms, or by clearing adjoining land in order to have a unit of sufficient size to support a family. It is felt that the problem will become more acute if the present occupants move away to find employment and new residents take over the farms. If full-time agricultural units other than poultry are to be maintained, it will be necessary to include in all cases a livestock enterprise in order to maintain and build soil fertility.

The minimum size of unit which is recommended for soils of the type found in the subarea is not less than 20 acres and 2,000 birds for a full-time poultry unit; a minimum of

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The minimum size of unit which is recommended for soils of the type found in the subarea is not less than 20 acres and 2,000 birds for a full-time poultry unit; a minimum of

60 cultivated acres for a dairy unit, and from 80 to 100 cultivated acres with 1,280 acres of range land for a beef cattle or sheep unit.

d. Land Clearing

Because of the number of part-time units in the subarea it is expected that there will be a tendency in the future to enlarge these units by clearing of additional acreages. There is some land in the community which is not considered to be suitable for farming because the cost of clearing would equal or exceed the value of the land. Soils of the Willamette and Salkum series are, in general, considered to be suitable for farming, and these soils should be cleared rather than unadapted types. Landowners are advised to consult soil maps available at the county agent's office before attempting to clear additional acreages.

e. Irrigation

The development of irrigation in the subarea is considered to be desirable where supplies of water are available. There is some possibility of gravity irrigation along some of the streams of the area. Sprinkler systems are recommended for fields that would require extensive land preparation for other methods of irrigation. In all cases irrigation would be on an individual basis.

II. Agricultural Areas Needing Major Adjustments

A. Subarea 3 (Colored single-hatch yellow)

1. Description

This subarea consists of some of the Columbia river bottom tidelands, which adjoin the hill lands, and Svensen island, which is entirely tideland. The subarea consists of scattered tracts located throughout the community, and includes 2,965 acres.

2. Problems and Recommendations

a. Drainage

About 735 acres adjoining the hill land need additional drainage in the form of intercepting drains to return water that comes from the hills into the main drainage channels.

In the case of Svensen island and the area immediately adjoining the foothills near Svensen, there is need of dike rebuilding to protect these lands from occasional overflow from the Columbia river. The present dikes are not adequate to protect the land during high flood stages.

[illegible] cultivated acres for a dairy unit, and from 80 to 100 cultivated acres with 1,200 acres of range land for a beef cattle or sheep unit.

d. Land Clearing

Because of the number of part-time units in the subarea it is expected that there will be a tendency in the future to enlarge these units by clearing of additional acreages. There is some land in the community which is not considered to be suitable for farming because the cost of clearing would equal or exceed the value of the land. Soils of the Willamette and Salkum series are, in general, considered to be suitable for farming, and these soils should be cleared rather than unadapted types. Landowners are advised to consult soil maps available at the county agent's office before attempting to clear additional acreages.

e. Irrigation

The development of irrigation in the subarea is considered to be desirable where supplies of water are available. There is some possibility of gravity irrigation along some of the streams of the area. Sprinkler systems are recommended for fields that would require extensive land preparation for other methods of irrigation. In all cases irrigation would be on an individual basis.

II. Agricultural Areas Needing Major Adjustments

A. Subarea 3 (Colored single-batch yellow)

1. Description

This subarea consists of some of the Columbia river bottom tidelands, which adjoin the hill lands, and Swensen island, which is entirely tideland. The subarea consists of scattered tracts located throughout the community, and includes 2,965 acres.

2. Problems and Recommendations

a. Drainage

About 735 acres adjoining the hill land need additional drainage in the form of intercepting drains to return water that comes from the hills into the main drainage channels.

In the case of Swensen island and the area immediately adjoining the foothills near Swensen, there is need of dike rebuilding to protect these lands from occasional overflow from the Columbia river. The present dikes are not adequate to protect the land during high flood stages.

Where drainage is an individual problem, assistance from the Extension Service in surveying drainage systems is available.

b. Land Clearing

There are some lands in the subarea that are suitable for cultivation when cleared. Clearing by using heavy machinery, such as bulldozers, is recommended, since this method is more economical and can be done much faster.

Nehalem Valley Community

This community comprises practically the entire Nehalem valley watershed which lies in Clatsop county. It is located in the southeast corner of the county.

I. Agricultural Area Needing Minor Adjustment

A. Subarea 2 (Colored yellow)

1. Description

This subarea is composed of the river bottom lands located along the Nehalem river and its tributaries. The soil types are principally Jewell and Chehalis. At the present time there are approximately 2,920 acres in cultivation in the subarea, with an estimated total acreage of 3,920.

Farms vary in size from 100 acres or more of cultivated land down to 10 or 15 acres of cultivated land per farm. The principal agricultural enterprise is dairying, with a small amount of other livestock production. The principal crops grown are perennial hay and pasture, although in the past, grain for hay has been grown. Grass seed production has been introduced on some farms.

2. Problems and Recommendations

a. Soil Fertility

The maintenance of soil fertility is an important problem in this community as well as in other farming areas in the county. Soil fertility should be improved and maintained by rotation of crops and by the addition of manure and commercial fertilizer and other practices as recommended for the other cultivated areas.

b. Irrigation

Greater use of irrigation on the farms of the subarea is recommended. Such development will enlarge the smaller units to more nearly an economic size and will make the larger units more efficient.

Where drainage is an individual problem, assistance from the Extension Service in surveying drainage systems is available.

b. Land Clearing

There are some lands in the subarea that are suitable for cultivation when cleared. Clearing by using heavy machinery, such as bulldozers, is recommended, since this method is more economical and can be done much faster.

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2. Problems and Recommendations

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The maintenance of soil fertility is an important problem in this community as well as in other farming areas in the county. Soil fertility should be improved and maintained by rotation of crops and by the addition of manure and commercial fertilizer and other practices as recommended for the other cultivated areas.

b. Irrigation

Greater use of irrigation on the farms of the subarea is recommended. Such development will enlarge the smaller units to more nearly an economic size and will make the larger units more efficient.

The sprinkler system of irrigation will have a wider adaptation on farms in the subarea than any other method because of the cost of land preparation for the other methods. However, in a few instances it may be possible to develop gravity systems.

c. Increase in Livestock

An increase in sheep and beef cattle numbers on the farms of the subarea is recommended in order that adjoining lands, which are being developed for grazing, can be utilized. The use of the range lands in Subarea 3-A by operators of the smaller farms in this subarea will make these farms more profitable, as they can be used to produce winter feed in connection with a livestock enterprise.

d. Land Clearing

The clearing of the better portions of the river bottom land which are not now in use is recommended, as the practice will enlarge the size of present units that are now too small or will add additional farms.

Heavy equipment for clearing, as recommended for other areas in the county, should be used in this subarea also.

e. Pasture Improvement

There is need for improvement of pastures on many farms.. Pasture mixtures currently recommended by the Extension Service for both bottom land and upland should be used.

II. Agricultural Areas Needing Major Adjustments

A. Subarea 3 (Colored single-hatch yellow)

1. Description

There are approximately 1,810 acres of land scattered throughout the Nehalem valley that are considered to be suitable for farming if cleared. Soils in these areas are composed mostly of Jewell and Chehalis series, which are some of the best in the county.

2. Problems and Recommendations

a. Land Clearing

The major adjustment needed in this subarea is land clearing. The use of bulldozers and other heavy equipment is recommended. When cleared, these areas should be added to existing farms in order to increase the size of uneconomic size farm units.

The sprinkler system of irrigation will have a wider adaptation on farms in the subarea than any other method because of the cost of land preparation for the other methods. However, in a few instances it may be possible to develop gravity systems.

c. Increase in livestock

An increase in sheep and beef cattle numbers on the farms of the subarea is recommended in order that adjoining lands, which are being developed for grazing, can be utilized. The use of the range lands in Subarea 3-4 by operators of the smaller farms in this subarea will make these farms more profitable, as they can be used to produce winter feed in connection with a livestock enterprise.

d. Land Clearing

The clearing of the better portions of the river bottom land which are not now in use is recommended, as the practice will enlarge the size of present units that are now too small or will add additional farms.

Heavy equipment for clearing, as recommended for other areas in the county, should be used in this subarea also.

e. Pasture Improvement

There is need for improvement of pastures on many farms. Pasture mixtures currently recommended by the Extension Service for both bottom land and upland should be used.

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2. Problems and Recommendations

a. Land Clearing

The major adjustment needed in this subarea is land clearing. The use of bulldozers and other heavy equipment is recommended. When cleared, these areas should be added to existing farms in order to increase the size of uneconomic size farm units.

B. Subarea 4 (Stippled yellow)

1. Description

There are approximately 118,780 acres in this subarea, which is entirely located in the Nehalem river watershed. It is composed of rough land, most of which has either been cut-over or burned-over, although there are a few tracts of timber in the subarea. Parts of the area have been logged as long as 50 years ago, and have been burned intermittently since that time.

Cover of the subarea consists mainly of stumps, logs in varying numbers, annual weeds, some native legumes, brush, and some young coniferous trees on limited areas.

A large portion of the subarea is owned by Clatsop county, as a result of foreclosure for taxes, or due to the fact that timber companies deeded land to the county in order to eliminate foreclosure expenses. The remainder is owned by private individuals or corporations in blocks of 1,000 acres or more.

2. Problems and Recommendations

The major problem of this subarea is that of development of grazing, and it is for this reason that it has been classified as in need of major adjustment. It is felt that the major portion of the subarea is suited for grazing development and that greater returns can be obtained from this use than from any other. Approximately 16,000 acres have already been acquired by five livestock operators who have seeded 3,600 acres to adapted varieties of grass up to the present time.

It is recommended that this entire subarea be classified as grazing land under Title 107, Chapter 4, O.C.L.A. Perennial grasses and clovers that have been found by the Experiment Station to be adapted to the area should be seeded following burning, or by other methods that have proved to be successful. It is felt that the program of the State Forestry Department for controlled burning of lands to prepare them for seeding to grass should be carried out where adapted in Clatsop county in cooperation with the county court and local operators.

Particular care should be taken by the operators to use grass seed which is free from weeds, and for this reason it is recommended that tests of seeds to be used should be made. In managing the grazing lands the recommendations of the Extension Service based on results of experiments and the experiences of livestock operators should be followed.

Where the income is to be entirely from the operation of range livestock, two sections of land are considered to be the minimum sized unit. All units should be assured of dependable winter feed supply from farm units in the Nehalem valley or

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Where the income is to be entirely from the operation of range livestock, two sections of land are considered to be the minimum sized unit. All units should be assured of dependable winter feed supply from farm units in the Nehalem valley or

nearby surplus feed areas. Preference should be given by the county in disposing of county-owned land in the subarea to operators in the Nehalem valley.

All land which supports a stand of timber should be protected until ready for harvest. After the logging of these lands, it is recommended that they be developed into grazing units.

To support the recommendation for the development of grazing in this subarea, the possible income per animal unit that may be expected from logged-off lands when they are properly seeded and utilized for grazing is shown in the following table:

Income per Animal Unit 1/
Coos and Curry Counties, 1939

Item	Average, 40 Ranches
Ranch receipts	$30.55
Ranch expenses	11.94
Ranch income	18.61
Interest on investment (5%)	8.33
Operator and family labor income	10.26

The income per animal unit shown in the above table was secured from a survey of 40 ranches in Coos and Curry counties in 1939. The average investment on these ranches surveyed was $33 per sheep and $167 per animal unit. Conditions in Clatsop county are considered to be similar enough to those existing in Coos and Curry counties to make these data applicable.

Seaside-Pacific Community

The Seaside-Pacific division of the county is composed of the Warrenton, Clatsop Plains, and Necanicum communities. It includes the beach resort section of the county. The agricultural sections are located in the northern part of the community along the coast and in the Necanicum river valley. The largest portion of the area is in forest.

I. Agricultural Areas Needing Minor Adjustments

A. Subarea 2 (Colored yellow)

1. Description

This subarea is located along the Coast highway, from the southern edge of Warrenton to approximately the north city limits of Seaside. It consists of approximately 3,830 acres.

1/Station Bulletin 381. "Ranch Organization and Range Land Use in Coos and Curry Counties, Oregon." Oregon State College and Bureau of Agricultural Economics Cooperating. December 1940

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Soil types are principally of the Hammond and Westport series. The black sand cover from which the area gets its name varies in depth from 3 or 4 inches to about 20 inches. There is some bulb production in the subarea and also a limited amount of vegetable production. Most of the area, however, is in native sod and is used for pasture.

2. Problems and Recommendations

a. Soil Fertility

Improvement and maintenance of soil fertility by the use of available barnyard manure and of nitrogen and phosphorous fertilizers is recommended.

b. Irrigation

There is need for development of irrigation in the subarea. In some instances irrigation water is available from lakes or streams, and in other cases it can be obtained from ground water sources. It is recommended that a survey to determine the ground water sources be conducted in the subarea. The sprinkler method of irrigation is considered to be best adapted to the local conditions.

c. Pasture Improvement

Pastures in the subarea are in general need of improvement. It is recommended that pasture mixtures suited for uplands be seeded after proper preparation of the lands. Grass varieties including English ryegrass, tall fescue, orchard grass, subterranean clover, and domestic and white clover are the best adapted varieties known at the present time. On the shallow soils, the addition of creeping fescue to the mixture is recommended.

II. Agricultural Areas Needing <u>Major</u> Adjustments

A. Subarea 3-A (Colored single-hatch yellow)

1. Description

This subarea is located along the Necanicum river in the southwestern part of the county. It consists of approximately 3,440 acres. The western portion of the area is made up of large dairy farms where some vegetables are produced for the fresh market. Extending further up the river the farms become progressively smaller. Vegetable production and poultry raising are the principal enterprises on these farms. Many of the smaller farms are part-time units, with the owner or occupant finding some employment in mills or logging camps.

Soils found in this subarea are principally of the Chehalis series.

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2. Problems and Recommendations

a. Soil Fertility

Improvement and maintenance of soil fertility by the use of available barnyard manure and of nitrogen and phosphorous fertilizers is recommended.

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There is need for development of irrigation in the subarea. In some instances irrigation water is available from lakes or streams, and in other cases it can be obtained from ground water sources. It is recommended that a survey to determine the ground water sources be conducted in the subarea. The sprinkler method of irrigation is considered to be best adapted to the local conditions.

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II. Agricultural Areas Needing Major Adjustments

A. Subarea 3-A (Colored single-hatch yellow)

1. Description

This subarea is located along the Mecanicum river in the southwestern part of the county. It consists of approximately 3,440 acres. The western portion of the area is made up of large dairy farms where some vegetables are produced for the fresh market. Extending further up the river the farms become progressively smaller. Vegetable production and poultry raising are the principal enterprises on these farms. Many of the smaller farms are part-time units, with the owner or occupant finding some employment in mills or logging camps.

Soils found in this subarea are principally of the Chehalis series.

2. Problems and Recommendations

a. Riverbank Erosion

The major problem of the subarea is that of riverbank erosion along the Necanicum river. The most serious erosion is occurring at nine locations extending about eight miles along the river from tidewater to the forks. Damage that is being done consists principally of undermining banks, overflowing, and cutting of new channels. In some instances, farmland is being destroyed.

A soil conservation district has been organized in this community, principally with the objective of controlling the streambank erosion. Formation of such a district is approved, and it is recommended that the activities of the Soil Conservation Service and other agencies involved be continued.

b. Land Clearing

There is a large acreage in this subarea that is considered suitable for development into farmland. The land is now in stumps and brush. It is recommended that the areas which are found to be adapted to cultivation be cleared by the use of heavy equipment, as recommended for the clearing of other subareas in the county.

The land cleared may be added to present farms in the area to increase their cultivated acreage, or in some instances the development of new farms may be possible.

c. Drainage

There is a need for drainage in some parts of the subarea. It is felt that by clearing out log jams and debris in the main river channel drainage will be improved. Opening of the channel in Muddy creek, and in some instances making minor changes in the channel, will greatly improve the drainage situation in this vicinity. In both instances it is recommended that the Soil Conservation Service, through the activities of the conservation district, take action on this problem.

d. Size of Farm Unit

As opportunities for employment in the lumber industry become less, it will be necessary to enlarge the part-time units to farms of an economic size. In some instances it will be possible to add to the size of the farms by clearing additional land, and in other cases it will be necessary to consolidate with other farms.

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The minimum size of farm unit that is recommended for the type of land in this subarea would be 20 acres of cleared bottom land. However, for most operators from 25 to 30 acres is considered a more desirable size.

B. Subarea 3-B (Colored single-hatch yellow)

1. Description

Subarea 3-B extends from the southern edge of Warrenton to Neawanna and consists of approximately 3,260 acres. The agriculture of the subarea is limited to a few small farming units which at the present time are producing vegetables, dairy products, and in a few instances, cranberries. The area as a whole is undeveloped. The subarea consists mostly of peat soils that are adapted to the production of cranberries.

At the present time there are about 70 acres of cranberries being grown in the area. While much of the subarea is suitable for the production of this crop, its development is limited because of the high cost of the preparation of the land.

2. Problems and Recommendations

a. Drainage

For the production of all crops, except cranberries, this area needs drainage. Any project should provide for controlled drainage in order to protect the cranberry industry, which needs water in winter and early spring. It is recommended by the committee that the areas north and south of Cullaby lake be drained, and at the same time maintain the lake level. Opening of the "Little Ditch" is desirable in order to drain another portion of the area.

It is recommended that the possibilities of joining this area with the Warrenton soil conservation district be investigated. It is felt that if this would be possible, assistance could be secured with the community-wide drainage problem.

b. Land Clearing

It is estimated that there are approximately 1800 acres in the subarea that would be adapted for farming if cleared. Methods of land clearing recommended for other subareas would apply in this section.

C. Subarea 3-C (Colored single-hatch yellow)

1. Description

This subarea consists of 5,960 acres, practically all of which is located within the city of Warrenton. Much of the

The minimum size of farm unit that is recommended for the type of land in this subarea would be 20 acres of cleared bottom land. However, for most operators from 25 to 30 acres is considered a more desirable size.

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2. Problems and Recommendations

a. Drainage

For the production of all crops, except cranberries, this area needs drainage. Any project should provide for controlled drainage in order to protect the cranberry industry, which needs water in winter and early spring. It is recommended by the committee that the areas north and south of Gullaby lake be drained, and at the same time maintain the lake level. Opening of the "Little Ditch" is desirable in order to drain another portion of the area.

It is recommended that the possibilities of joining this area with the Warrenton soil conservation district be investigated. It is felt that if this would be possible, assistance could be secured with the community-wide drainage problem.

b. Land Clearing

It is estimated that there are approximately 1000 acres in the subarea that would be adapted for farming if cleared. Methods of land clearing recommended for other subareas would apply in this section.

C. Subarea 3-C (Colored single-hatch yellow)

1. Description

This subarea consists of 5,960 acres, practically all of which is located within the city of Warrenton. Much of the

area is owned by the county, while the city of Warrenton has control over streets not yet vacated.

Soils in the subarea consist of Bayside and Brallier series.

2. Problems and Recommendations

a. Development of Agricultural Units

A large share of this subarea is not being used for agricultural purposes at the present time. One of the reasons for this situation is the involved ownership. It is suggested that suitable agricultural units be blocked out by the county by trading their lands with private owners and with the city of Warrenton. At the present time development is retarded because of the subdivision and platting of the subarea in past years. It will be some time before the county can repossess much of this area and make arrangements with the city of Warrenton to vacate streets, which will allow agricultural blocks to be laid out.

The size of farm which is considered as a minimum economic unit for the subarea is 40 acres of cleared land. Dairying and vegetable production are recommended as the best adapted types of agriculture for this section.

b. Land Clearing

There is a problem of land clearing before agricultural units can be developed. Methods of clearing as recommended for other subareas would be adapted to this locality as well.

c. Drainage

There is need for drainage on some of the lands in the subarea, but in practically all instances it is an individual farm problem. It is recommended that assistance in surveying and laying out drainage systems be given by the Extension Service to farmers in this subarea as in other areas of the county where this assistance is needed.

III. Agricultural Land that Should Be Retired from Agricultural Use

A. Subarea 5 (Colored blue)

1. Description

This subarea, approximately 1,530 acres in size, consists of the ocean front section known as the dune or blow area. It is located directly adjoining the ocean front from Gearheart north to Fort Stevens.

area is owned by the county, while the city of Warrenton has control over streets not yet vacated.

Soils in the subarea consist of Bayside and Brallier series.

2. Problems and Recommendations

a. Development of Agricultural Units

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III. Agricultural Land that Should Be Retired from Agricultural Use

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1. Description

This subarea, approximately 1,530 acres in size, consists of the ocean front section known as the dune or blow area. It is located directly adjoining the ocean front from Gearheart north to Fort Stevens.

2. Problems and Recommendations

Wind erosion has been a serious problem in this area for a number of years, and as a result damage has been done to adjoining agricultural areas. The Soil Conservation Service, working in connection with a CCC camp, has worked in the area for five years on a program of stabilization. Recently a soil conservation district has been organized in the area to enable continuance of the conservation work.

It is recommended that neither grazing nor cultivation be permitted in the subarea so that it may be permanently stabilized. Formation of a soil conservation district is approved, and it is recommended that activities of agencies involved in the conservation program of the subarea be continued until the wind erosion problem is solved.

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Bibliography

"An Area Plan for Land Use, Clatsop County, Oregon." Vernon W. Baker, Assistant Agricultural Economist, Bureau of Agricultural Economics, United States Department of Agriculture. 1940

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Bibliography

"An Area Plan for Land Use, Clatsop County, Oregon." Vernon L. Sater, Resident Agricultural Economist, Bureau of Agricultural Economics, United States Department of Agriculture. 1940

ADDRESS BY DIRECTOR MARION CLAWSON OF THE BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR, AT THE MIDYEAR MEETING OF THE ROCKY MOUNTAIN OIL AND GAS ASSOCIATION AT GREAT FALLS, MONTANA, JUNE 14, 1952.

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BUSINESSLIKE MANAGEMENT OF FEDERAL LANDS

Mr. President, Mr. Chairman and Members of the Association:

I am happy indeed to have the opportunity of meeting with you this morning. It is customary for a speaker to express his pleasure at talking with a group, but in this instance I have several reasons to be particularly gratified at this opportunity. I have a very high opinion of your association and its accomplishments. As you perhaps know, I am not a specialist in matters relating to the oil and gas industry but I am glad to have any opportunity to become better informed about this vital American industry.

In the Bureau of Land Management we are very proud of the good relationships which we enjoy with all groups using the public lands. We do not wish to accept the present relationships as perfect, but on the other hand we constantly strive to achieve even better working relationships with the various industry groups. We make extensive use of advisory boards, such as our grazing advisory boards, our forest advisory boards, conservation advisory boards and the like. We also seek the advice and counsel of various industry groups such as yours. We try to encourage industry of all kinds and all individuals to make the fullest possible use of the public lands. As a matter of principle, we believe that it is possible to protect the public interest fully and the interests of the Government as a landowner, while at the same time co-operating fully with industry in order to facilitate its use of the public lands.

The Federal lands under our jurisdiction are extensive in area, valuable for many purposes, and greatly in demand. They produce many essential products each year and their possibilities for increased production are almost unlimited. Among

the uses of these lands one of the most important is the production of oil and gas. This activity is particularly important in terms of the revenue it produces.

As you know, the Bureau of Land Management is one of the few Federal agencies which produces more revenue than it receives in appropriations and much of this money flows from oil and gas leases. The revenues from the Mineral Leasing Act are produced in part by our activities and in part by the Conservation Division of the Geological Survey. Including all royalties and rentals from oil and gas leases on the public land and all other revenues on such lands, the total receipts have increased roughly $10 million annually in 1942 and 1943, up to almost $50 million in fiscal 1951. BLM receipts have run roughly six times the amount of our appropriation. By far the greater part, roughly three-fourths in fact, of these receipts have come from the Mineral Leasing Act. Most of these latter receipts have come from oil and gas leasing and of these most has come from the producing leases. However, at the present time the rentals on nonproducing oil and gas leases are at least one-fifth of the total receipts from oil and gas and in themselves are almost as large as the entire appropriation for the Bureau of Land Management.

It is evident from the foregoing statistics that my earlier statement to the effect that public lands are valuable and in demand is no exaggeration. As you can see, the oil and gas industry is one of the most active elements in that large demand for public land and you have the distinction of being the most revenue-producing part of that demand.

Let us look, however, at the whole picture of the public lands. We administer approximately 184 million acres of public land in the continental United States, most of which is located in the 11 Western States. In addition, there are

approximately 55 million acres of land, the title to the surface of which has passed to private owners and for which the mineral rights have been retained by the Federal Government. We administer these lands also. In addition, we administer the mineral activities, particularly mineral leasing on some 176 million acres of other Federal land, the surface of which is administered by other Federal agencies. This includes soil conservation, forest service, acquired lands, land utilization and some in reclamation and wildlife projects. There are over 33,000 livestock operators who have grazing permits, licenses or leases for land under our jurisdiction. Such lands provide an important and often critical part of the forage needed for a substantial part of the total western livestock industry. We sell roughly 500 million feet of commercial timber annually which this year will bring in roughly $10 million in income. The present capacity of the grazing lands is fully used, but we believe that this capacity could be increased by about 30 per cent over a period of years through reseeding, waterspreading and other improvements. Only about one-half of the sustained yield capacity of the forest lands is used at present due almost entirely to a lack of adequate appropriations for this activity. Since this activity returns roughly $4. income for every dollar spent it is good business, as well as good forestry to step the annual cut up to the sustained yield capacity. Concurrence in this view is gradually being achieved with the Bureau of the Budget and Congress and we are hopeful that in the future forested lands can contribute their maximum share to the economic well-being of the West. A substantial proportion of the game animals of the West graze at some season of the year on public lands. These lands are in heavy demand for recreation, for sites for living and for business, for rights of way and in innumerable other ways.

I am sure that you are most interested and most informed about mineral leasing activities on the public land. The number of applications under the Mineral Leasing Act, most of which are oil and gas leases, averaged roughly 5,000 annually during the war and the immediate postwar years. Since the war the number of applications filed annually has increased steadily and for the present year will exceed 20,000. As materials and labor have become more available, as well as interest in oil possibilities shifting into new areas, the demand for oil and gas leases on the public lands has increased materially.

This is dramatically illustrated by the great rush of filing of oil and gas lease offer applications for both public lands and acquired lands in the Williston Basin, which was opened up by last year's discovery in North Dakota, and which may prove to be one of the largest producing oil fields in the Nation. The number of leases in effect has gone up steadily from slightly over 3,000 in 1942 to over 41,000 on last June 30. The number of such leases in effect will almost certainly continue to rise since there seems to be no slacking off but rather an increasing demand for oil and gas leases on the Federal lands. As of last June 30 over 32 million acres were under oil and gas lease. Approximately one-third of all Federal lands in the State of Wyoming are now leased for oil and gas. The large number of leases in effect involves considerably work on our part, particularly for accounting, for assignments, and the like. This is in addition to the large amount of work connected with new leases each year.

I have noted the other uses of these public lands, for in our administration of these we must strive to attain the maximum use of the land for all purposes. This is the multiple-use idea which has been so widely discussed. The same tract of land can often be used for more than one purpose at the same time. It can provide grazing for domestic livestock, while at the same time serving as a home for

wildlife, providing adequate watershed control, and providing some recreational values at the same time. Frequently trees growing on the land can be harvested without interference with other uses. Oil and gas and other minerals can be extracted from the land without serious interference with surface uses. These various uses of the same tract of land often do not conflict or often can be adjusted so as not to conflict seriously with each other.

An excellent example of this type of multiple-use and one which does great credit to the oil and gas industry is to be found in this region. A few years ago we found that seismographic and other exploratory crews for the oil and gas industry were conducting their surveys over the public lands in such a manner as to create some interference with the livestock industry and some hazard of increased erosion. We felt that these operations were not incompatible with surface uses of the land if they were properly carried out. Through discussion with your association, it was possible to work out a constructive solution to this problem. I know there are men present here today who were directly concerned with this problem.

The oil and gas industry as represented by your association developed a code of ethics for operation on the public lands. The industry recognized its responsibility to respect the rights of other users of the public lands and to prevent or minimize damage to those lands. The industry agreed to police itself in order to obviate the necessity of restrictions and control imposed by the Federal Government. This worked excellently from 1948, when it was adopted, for about three years, and complaints concerning improper seismograph operations so far as surface uses were concerned were at a minimum. The two or three complaints which were received during that period were turned over to the proper body of your organization

and were effectively and satisfactorily disposed of. Last fall, however, possibly as a result of increased seismograph activity and the entering into the area of new crews who may not have been entirely familiar with the Code of Ethics, a series of complaints were received by our district office with reference to damage to surface or improvements. Upon notification, your association took prompt steps to call a meeting in Casper, Wyoming in February to consider this matter and another meeting in Worland in March. As a result of these meetings and the further steps which it was indicated would be taken to prevent damage, I have every reason to believe that the Code of Ethics will continue to work as satisfactorily in the future as it has heretofore. The panel exhibit of photographs which is on display here, showing some surface damage as a result of seismograph work, as well as certain aspects of range improvement work which the Bureau performs, may be of interest to you. On the whole, the industry has shown a real responsibility for the rights of others.

I think you will be interested to know that the oil and gas industry and the livestock industry have evolved a similar arrangement in the Southwest. The arrangement in that area has drawn directly upon your experience in this and adjoining States. When we encountered a similar problem in the Southwest our men in this region told our men in the Southwest of the experience here and the formulation of the Code of Ethics. As a result, a group representing both industries, as well as our agency and other Federal agencies was established, particularly for the San Juan Basin. This group has also prepared a code of ethics patterned at least somewhat after yours. They have gone perhaps one step further than you did in the preparation of an attractive and very well written pamphlet called "Code of Ethics" to establish better relations between ranchers or ranch owners and the oil

and gas companies operating in the San Juan Basin. If you have not seenthis little book I think you will be interested in it. It seems to me that in this Code of Ethics we have a specific and constructive instance of two industries and a Federal agency working together constructively to solve a common problem.

It may well be that we will have to promulgate some regulations to require oil explorers not members of your association to adhere to the provisions of the Code of Ethics which you voluntarily adopted.

There are some matters of direct interest to you which I would like to mention briefly. As you know, roughly four years ago we decentralized most of our oil and gas leasing work to our district land offices here in the West. In my judgment the results have been highly satisfactory. In spite of the greatly increased number of oil and gas applications, and in spite of the fact that our staff on this work is actually less than it was four years ago, the backlog of pending applications has been very greatly reduced and the work brought nearly current.

One factor which has helped in speeding up work has been the development of the present offer to lease and lease form with which I know you are all familiar. The use of this form has greatly reduced our routine clerical work and enabled us to get out more leases with the same staff. Perhaps more important, this form has materially reduced the deliberate cross-filing and deliberate filing of conflicting applications. Our Billings Land Office has unfortunately fallen somewhat behind in the last year due to the flood of applications resulting from the discoveries in the Williston Basin. The issuance of leases for the acquired lands is seriously in arrears and unfortunately not getting better.

With these two exceptions, however, the work of the Bureau of Land Management on oil and gas leasing is essentially current. Our Wyoming, Colorado, Utah,

Nevada, California and Arizona offices are each essentially current in their work. Although no oil has yet been discovered in Nevada we have had many hundreds of applications in that State with several rather sharp runs. In spite of the increase in business, that office has remained essentially current throughout. The Wyoming office managed several months ago to get current in spite of its very heavy workload and continues essentially current. The Colorado and Utah offices have managed to get essentially current. Naturally, we are pleased at these situations but by no means satisfied until all of the work of the Bureau is completely current.

The Department has under consideration at the present time several proposals for simplifying the procedure in oil and gas leasing of acquired lands. It is proposed to develop a form roughly similar to that used for public domain and to decentralize this work to the district land offices as far as possible. I am convinced that substantial economies can be made in this activity so that we can turn out a great deal more work with the present staff.

In closing, I should like to raise one matter and I do so rather hesitantly. As I said at the beginning and as you fully realize, I am not a specialist in oil and gas activities. As a result, I may seriously misunderstand some of the facts which I have, but I am going to raise to you a question which concerns me considerably. I cannot help but wonder if there is not too much speculation in oil and gas leasing on the public lands and not enough actual development. The fact that we issue roughly 20,000 leases a year and that we now have nearly 50,000 leases in effect, while at the same time the number of tracts tested by drilling on them or within a reasonable distance, probably is less than 1,000 annually, and the further

fact that there are not over 2,500 producing oil and gas leases on the public lands, seem to me to be significant.

Perhaps these are normal ratios for your industry, but to me they appear to raise the question of speculation as contrasted with development. Moreover, there are some extremely speculative practices followed, at least by some individuals in the leasing of public lands for oil and gas. For instance, at least one operator has taken to filing leases in his own name of which he then relinquishes a 40-acre tract at a time, with the filing of an application by him but in someone else's name for each relinquished 40-acre tract as soon as the relinquishment is noted on the records. We understand that he collects $300 from each applicant for each 40-acre tract of the most completely unproven and unlikely types of Federal land for oil and gas development. Other agents have advertised extensively in eastern newspapers, urging readers to apply through them for leases on 40-acre tracts. The agents' fee in this case is $100. We have had an instance recently in which a land agent obtained signed applications from a number of clients which were then filled out at a later date to take advantage of whatever interest had been shown by actual oil developments. In this case we ruled that applications of this type were invalid since the applicant's signature warrants that he subscribes to all of the information required in the application. The use of dummy names for filing is suspected of wide occurrence, although it cannot be proven. I could go on with other illustrations of such speculative practices but I suspect that many of you are far better informed on this point than I am. I realize that this type of filings may be carried on by a group whose activities might be more thoroughly described as "mail order promotion", having little relationship to the legitimate oil and gas industry.

Everyone recognizes that the development of previously unproven territory for oil and gas production is a speculative undertaking. As a matter of fact, all private business is speculative at least to a degree. There is nothing wrong or undesirable about speculation. What I am concerned with is the type of speculation which is more anxious to exploit other people than it is to try to develop resources. Perhaps I am overly concerned with this matter, as I stated earlier. Certainly any steps which might be taken to reduce or inhibit the person who speculates in another person's gullibility must be devised to avoid hindering and hampering the legitimate oil and gas industry which necessarily speculates as to whether or not there is oil and gas in paying quantities in a particular area. This is a problem which I would like to see your association consider and give us your best views. I am of the belief that we will be forced to take some positive steps to reduce or control these unproductive types of speculation.

I have enjoyed talking with you today and look forward to continued support from your organization in achieving our mutual objective of legitimate development of oil and gas on the public domain.

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AN OVER-ALL APPRAISAL AND OUTLOOK FOR PUBLIC LAND RESOURCES IN THE WEST

By: Marion Clawson, Director
Bureau of Land Management

The history of the public lands of the United States is to a large extent the history of the United States itself, and is, to this writer, fascinating. Economic, political, sociological, technological, and other aspects of public land history each have their absorbing stories.

The scope of this statement is limited to the 11 Western States, where most of the Federally-owned land lies today. It is largely directed to the economic aspects of these lands, with only minor attention to the administrative problems of BLM; and it is concerned chiefly with the lands under the jurisdiction of BLM--an area that was once called "the unreserved and unappropriated public domain".

WESTERN ECONOMY

Growth is the dominant keynote

of the economy of the West and of the United States. An expanding output and an enlarging market have provided the opportunity for private business expansion, have put an ever-increasing strain on our natural resources, and have come to mold the outlook and attitude of our people.

No one economic measure perfectly describes economic growth in all its aspects. Total population is perhaps the best all-round measure, since people are producers, consumers, political forces, and otherwise enter into the whole economy and social structure. Total population does not include per capita growth, but it is a good starting place.

Population increase has been large and sustained

in both the United States and the West. (See Figure 1, and Table 1). It has ranged from 7% to 26% in a single decade for the Nation; from 17% to 78% for the West. In only 1 out of 8 decades has Western growth been less than double National growth, and it has averaged over 2½ times as great. Both areas had more rapid increase in the 1940's than in the 1930's, and the West's was greater than for the two preceding decades as well.

Migration has largely built the West.

Over two-thirds of all persons living in California were born elsewhere; relatively few native-born Californians live in other States. Other western States have had large growth by migration, but not as much as California. Migration was formerly mostly young adults, with a sprinkling of retired oldsters; now it is more nearly average in age distribution. Migration has brought large material wealth to the West, as well as a large trained productive labor force; it has brought its headaches, too.

Population growth varies among Western States.

Although population has increased markedly in all western States since 1870, or even since 1900, and although it has increased some in every State in almost every decade, the growth pattern varies greatly. (See Figure 2). Particularly noteworthy is California, whose share of western population has risen from one-third in 1900-1910, to over half today. (See Table 2). Some other States hit nearly a plateau after 1910 or 1920; almost all had accelerated growth in the 1940's.

Population will surely increase in the future

in both the West and the Nation, but nobody knows how fast or how much. Most usual guess for U.S. is 190 million by 1975; continuation of 14% growth rate of 1940's would mean about 210 million by 1975 (compared with 152 million in 1950). One reasonably authoritative guess is over 33 million for the West by 1975; continuation of its 41% growth rate for the 1940's would mean about 46 million by 1975 (compared with 19½ million in 1950). On the basis of the past 50 years experience, California will continue to grow faster than other States, and to be an increasingly larger share of Western total.

Further population increase will bring opportunities and problems.

More people will demand more natural resources. The burden is likely to fall heavily on public lands.

FIG. I

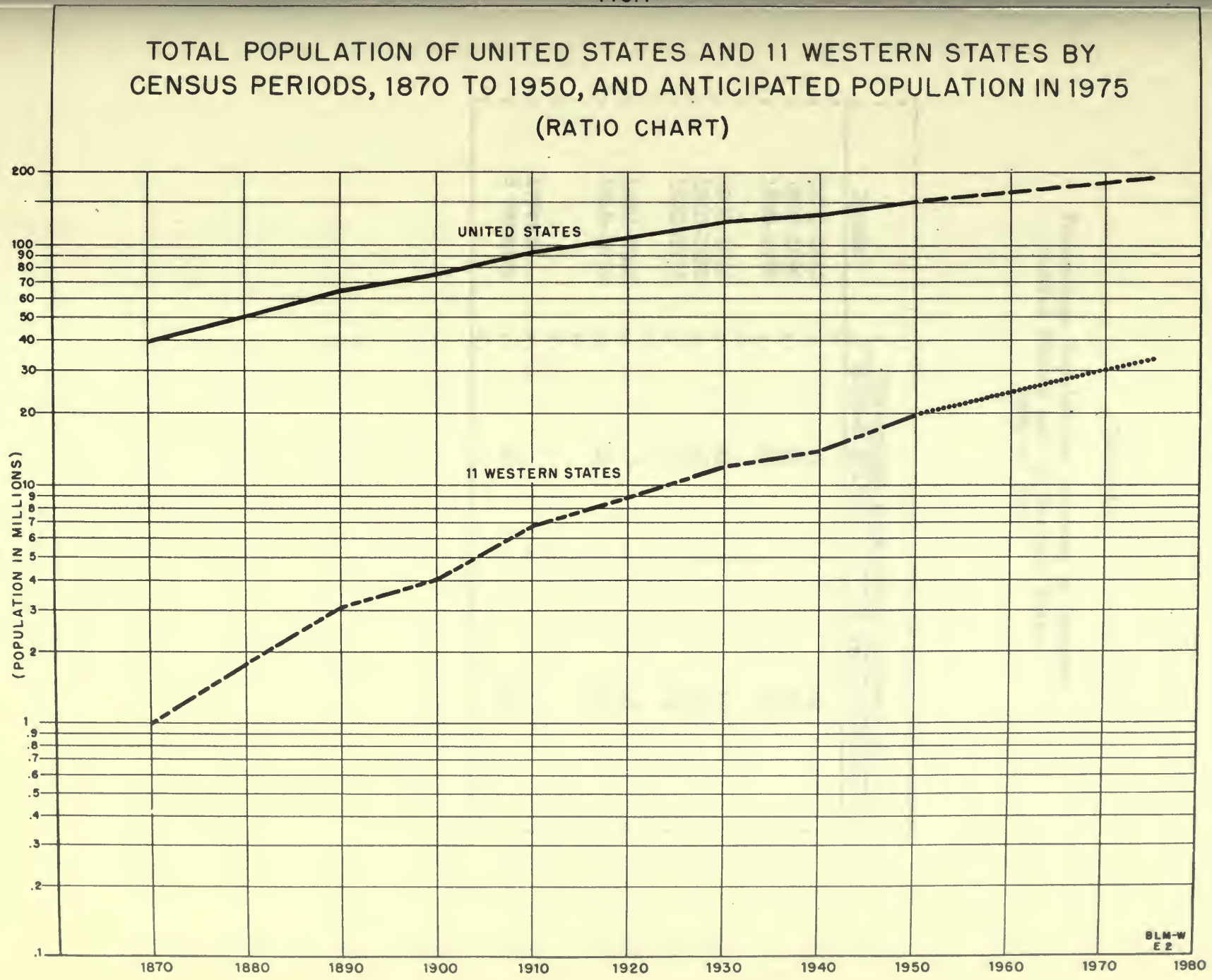
TOTAL POPULATION OF UNITED STATES AND 11 WESTERN STATES BY CENSUS PERIODS, 1870 TO 1950, AND ANTICIPATED POPULATION IN 1975
(RATIO CHART)
UNITED STATES
11 WESTERN STATES
(POPULATION IN MILLIONS)
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
.9
.8
.7
.6
.5
.4
.3
.2
.1
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
BLM-W
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Table 1.

Percentage Population Increase by Decades,
United States and 11 Western States,
1870 to 1950

Decade	Percentage population increase in United States	Percentage population increase in 11 Western States
1870-1880	26	78
1880-1890	25	75
1890-1900	20	32
1900-1910	21	67
1910-1920	15	30
1920-1930	16	34
1930-1940	7	17
1940-1950	14	41
Average, 8 decades	18	47

TABLE 1

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[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
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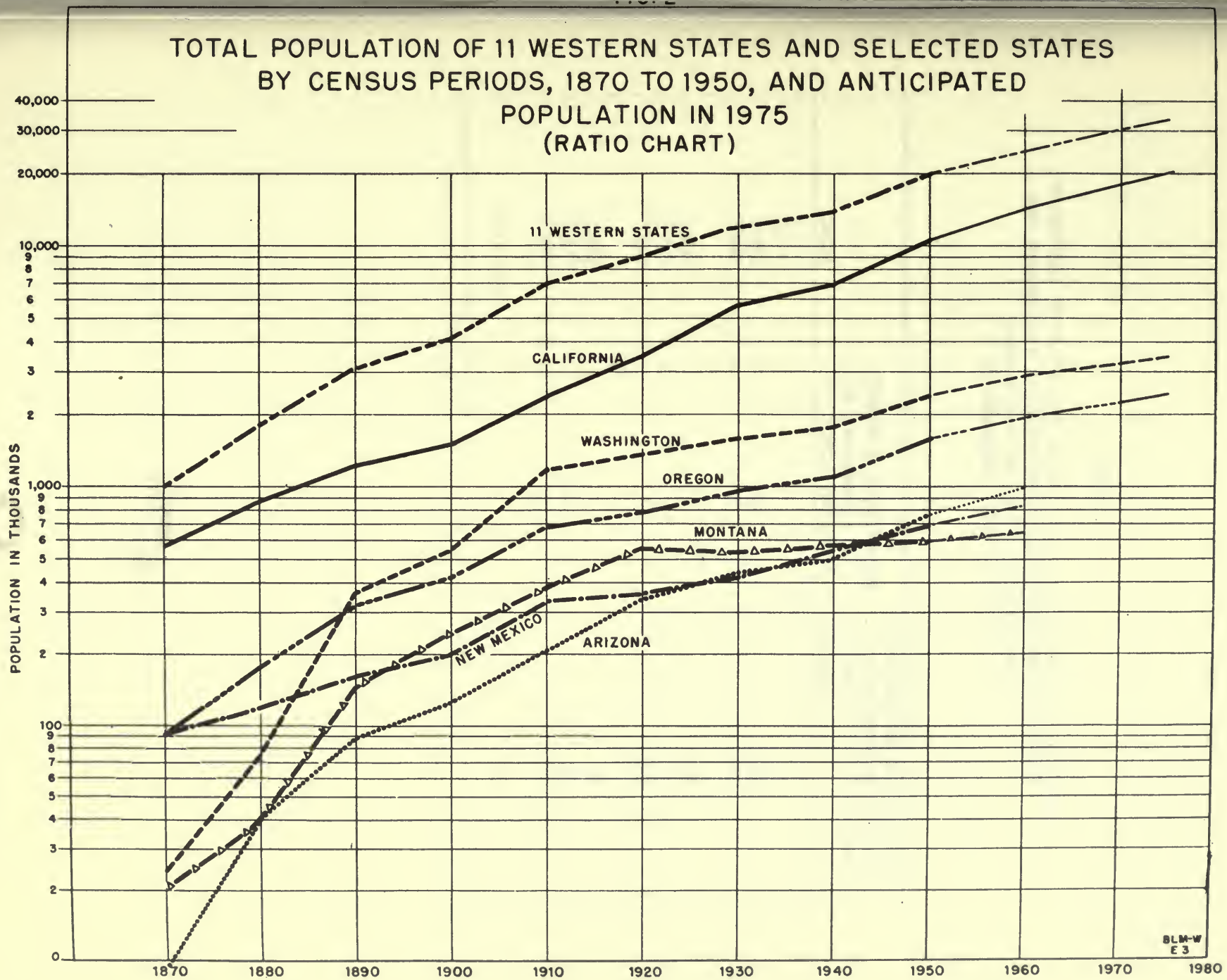

TOTAL POPULATION OF 11 WESTERN STATES AND SELECTED STATES
BY CENSUS PERIODS, 1870 TO 1950, AND ANTICIPATED
POPULATION IN 1975
(RATIO CHART)
POPULATION IN THOUSANDS
40,000
30,000
20,000
10,000
1,000
100
11 WESTERN STATES
CALIFORNIA
WASHINGTON
OREGON
MONTANA
NEW MEXICO
ARIZONA
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
BLM-W
E 3

Table 2.

Percentage Western population was of National population, and percentage California's population was of total population in 11 Western States, by decades, 1870 to 1950

Date	Western population, as percentage of National population	California population, as percentage of population in 11 Western States
1870	2	57
1880	4	49
1890	5	39
1900	5	36
1910	7	35
1920	8	38
1930	10	48
1940	11	50
1950	13	54
Average	7	45

HISTORY OF PUBLIC LANDS IN GROWTH OF WEST

Public lands were especially important in the economic development of the West. A brief review of Western history, with emphasis on the role played by public lands, should provide an interesting background to a consideration of present day problems.

Furs

especially beaver, brought the first big exploration and exploitation of the 11 Western States. The first half of the 19th Century was the heyday of beaver trapping, both absolutely and relatively to other activities. This took place entirely on land not privately-owned, but that belonged to the United States or other countries.

Gold

was the next major force for migration to the West, beginning with the California Gold Rush of 1849. It and the other precious metals pushed exploration to every remote part within a few years, and provided much of the impetus for economic, transportation, and political development of the Western States. Gold production in California reached a peak of over $80,000,000 in 1852; from this peak the value of production declined rapidly in California, and for the West as a whole the value of gold produced did not exceed the early California peak until 1937. (See Figures 3, 4, 5, 6). In the meantime, by 1890, other metal production was at a higher value than for gold, and has long since left gold far behind. By the end of World War I, the value of petroleum production rose rapidly, and petroleum has been the most important single mineral, as to value, since that time. Since both the volume of mineral production and the price of minerals vary greatly from year to year, the value of mineral production fluctuates widely. This is true for the West as a whole, and even more apparent in each of the Western States. Of the total mineral production of all kinds in the United States in 1950, almost exactly half came from the 29 public land States, and nearly one-third from the 11 Western States. (See Table 3). Data do not exist to show the percentage of the mineral production in the public land states obtained from land originally taken into private ownership under the mining laws. As a guess,

probably well under half of all annual mineral production in the public land States comes from land originally secured to private ownership by operation of the mining laws.

Transcontinental Transportation

helped build the West, and Western growth increased the need for better transportation. Public lands have been a vital factor in the development of transcontinental transportation. Furs and gold rushes led to a full exploration of the West, but solid development depended on transportation. Land grants were the deciding factor which led to transcontinental railroad construction. Substantial acreages of public land were given the railroads. (See Figure 7). Important concessions were given the Government in return. Later, with the coming of the automobile and truck, good paved highways became highly important. They have been built through the West in large part by Federal grants-in-aid, which in turn were based in part upon the acreage of Federal land per State. In more recent years, air fields and landing strips have frequently been built upon Federal land.

Grazing

of domestic livestock on public land was early a major activity in the West. Throughout American history there had been a frontier grazing industry, held to a narrow fringe because of hostility of Indians. After the Civil War, there began major drives of cattle from Texas northward, to shipping points along the new transcontinental railroad. Cattle drives were gradually replaced by cattle raising. By 1890, nearly all the West suitable for grazing was used for that purpose. At first, this was almost entirely on public land. As time went on, ranches were forced to acquire and develop hay lands, to provide winter feed, and also to acquire grazing lands to protect themselves against other livestock men and against the homesteader. At one period, livestock shipped to Eastern markets was a major means whereby the West obtained cash to buy industrial goods from the East. Although the area of public land open to grazing has shrunk over the decades, public grazing is still a vital and integral part of a livestock industry which has grown and developed greatly. Most of its products now find a market in the West.

FIG. 3

VALUE OF MINE PRODUCTION

COLORADO

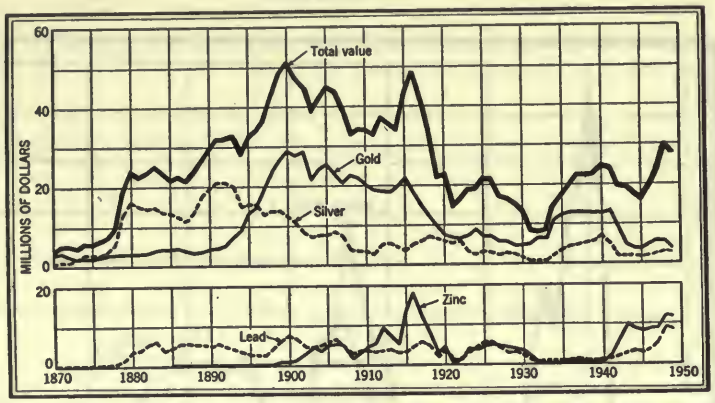


FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Colorado, 1870–1949. The value of copper has been less than $2,000,000 annually, except in a few years.

NEW MEXICO

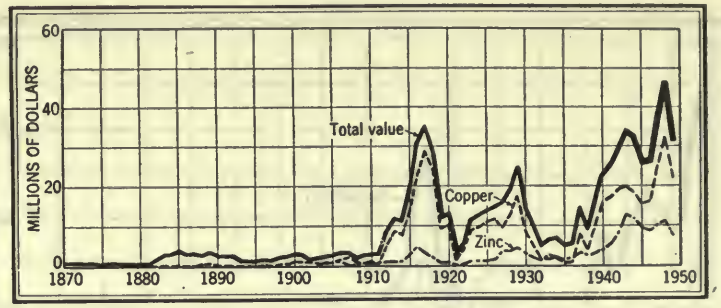


FIGURE 1.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1870–1949. The value of gold, silver, and lead produced annually has been relatively small.

MONTANA

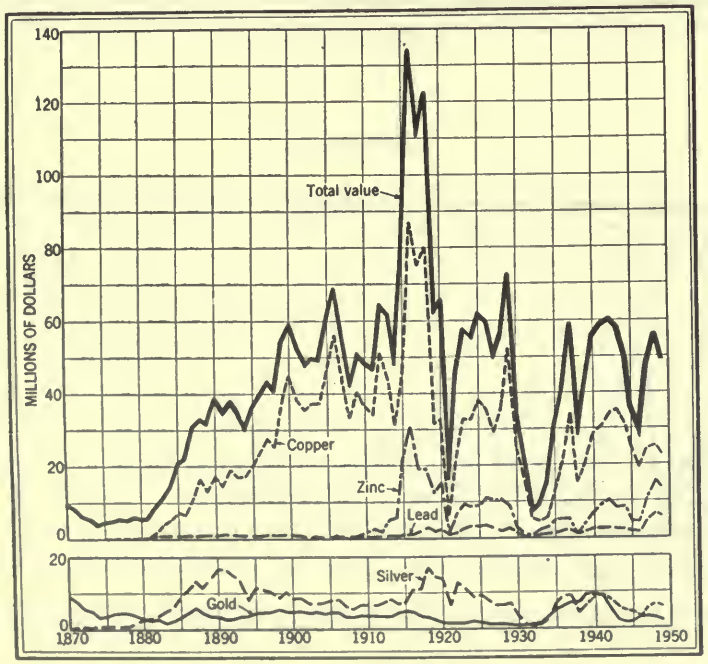


FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc, and total value in Montana, 1870–1949.

UTAH

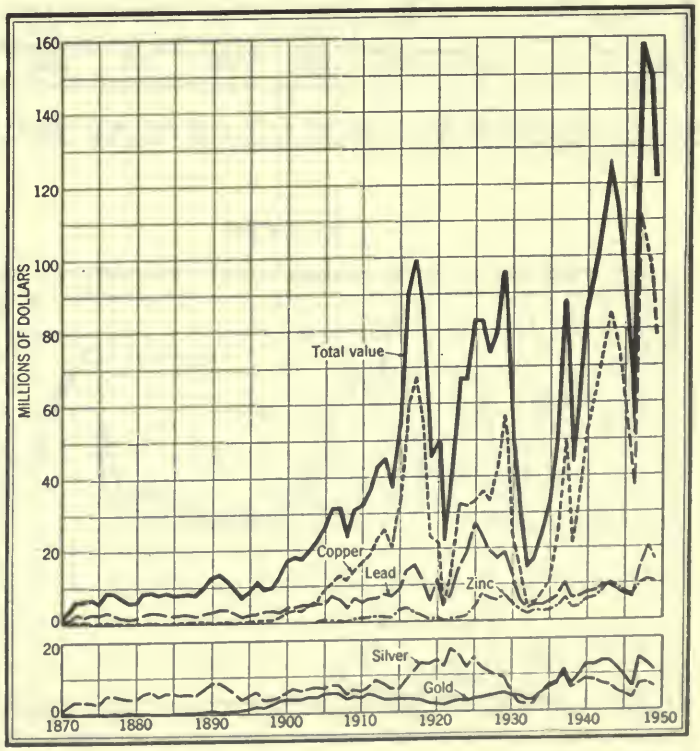
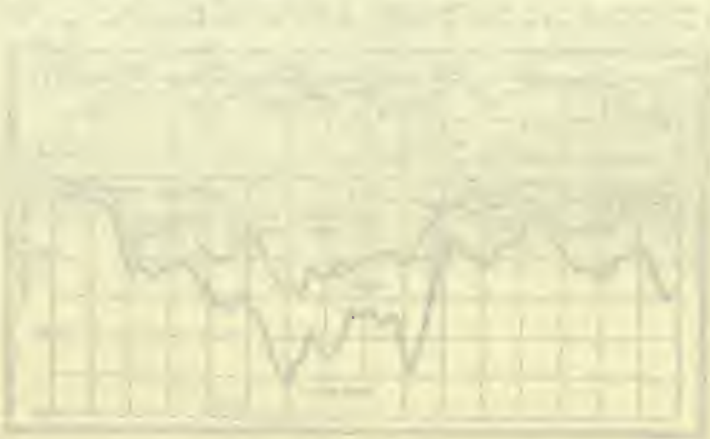


FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc, and total value in Utah, 1870–1949.

Reprint from Bureau of Mines Yearbook, 1949

Chart BLM-W-D-80



VALUE OF MINE PRODUCTION

OREGON

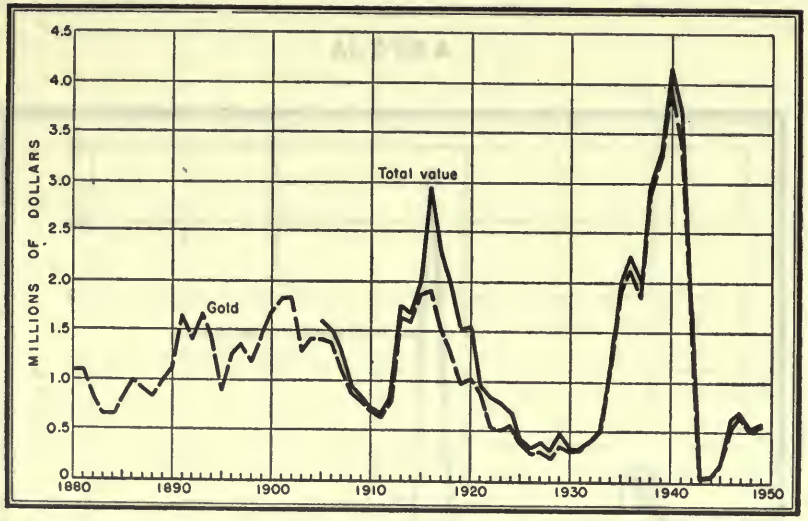


FIGURE 1.—Value of mine production in Oregon of gold, 1880–1949, and total value of gold, silver, copper lead, and zinc, 1905–49.

IDAHO

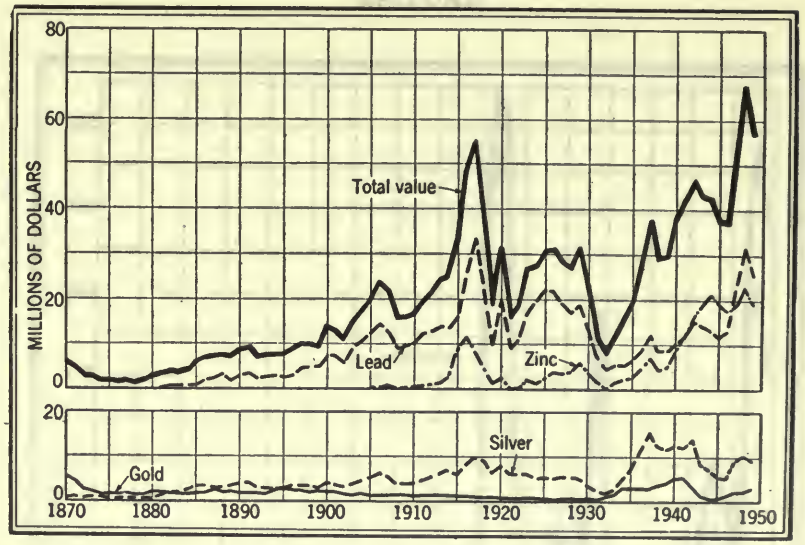


FIGURE 1.—Value of mine production of gold, silver, lead, and zinc, and total value of gold, silver, copper, lead, and zinc in Idaho, 1870–1949. The value of copper has been less than $2,000,000 annually, except in a few years.

CALIFORNIA

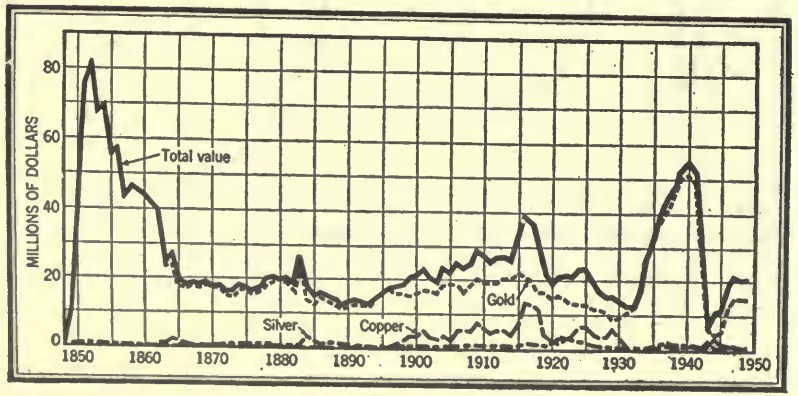


FIGURE 1.—Value of mine production of gold, silver, and copper, and total value of gold, silver, copper, lead, and zinc in California, 1848–1949. The value of lead and zinc has exceeded $1,000,000 in only a few years.

NEVADA

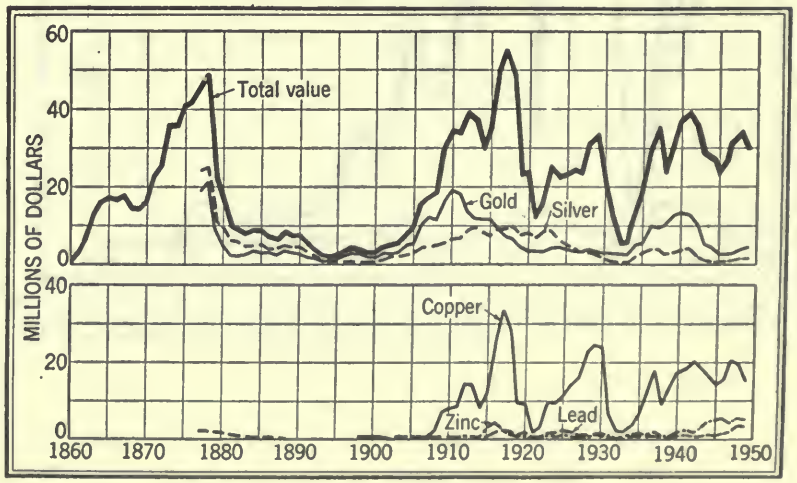
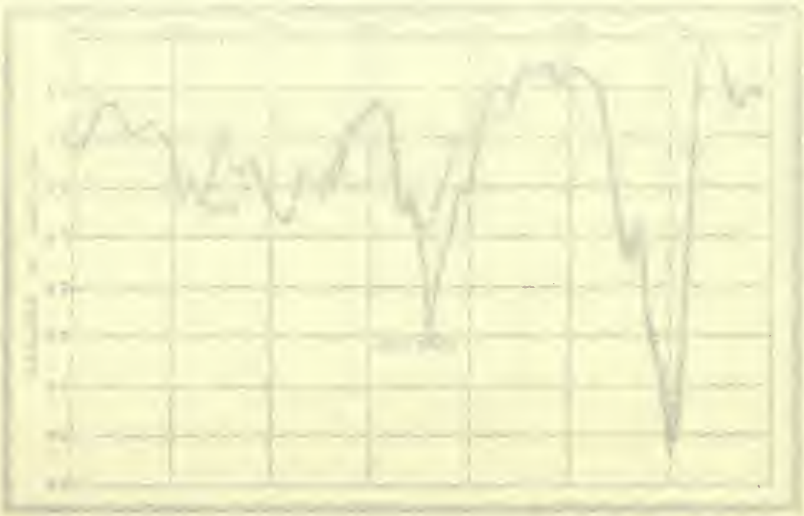


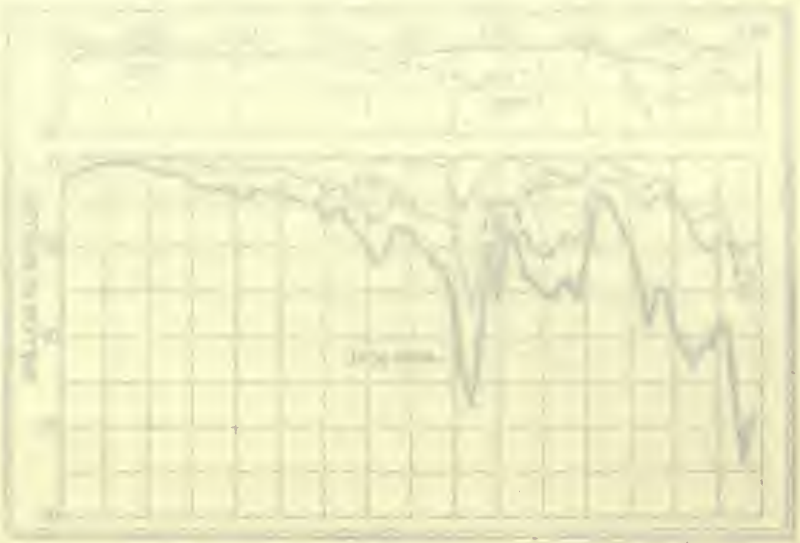
FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Nevada, 1860–1949.

Reprint from Bureau of Mines Yearbook, 1949

Chart BLM-W-D-81



OREGON



OHIO

VALUE OF MINE PRODUCTION

ALASKA

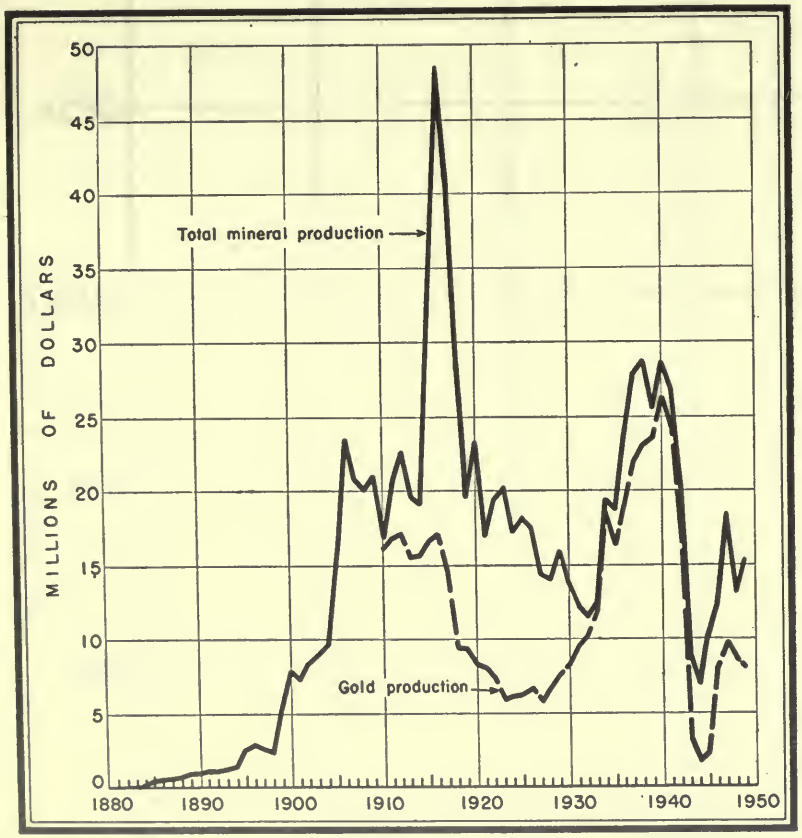


FIGURE 1.—Trends in value of total mineral production (1880–1949) and gold production (1910–49) in Alaska. From 1911 to 1931 copper production accounted for most of the value of minerals other than gold.

ARIZONA

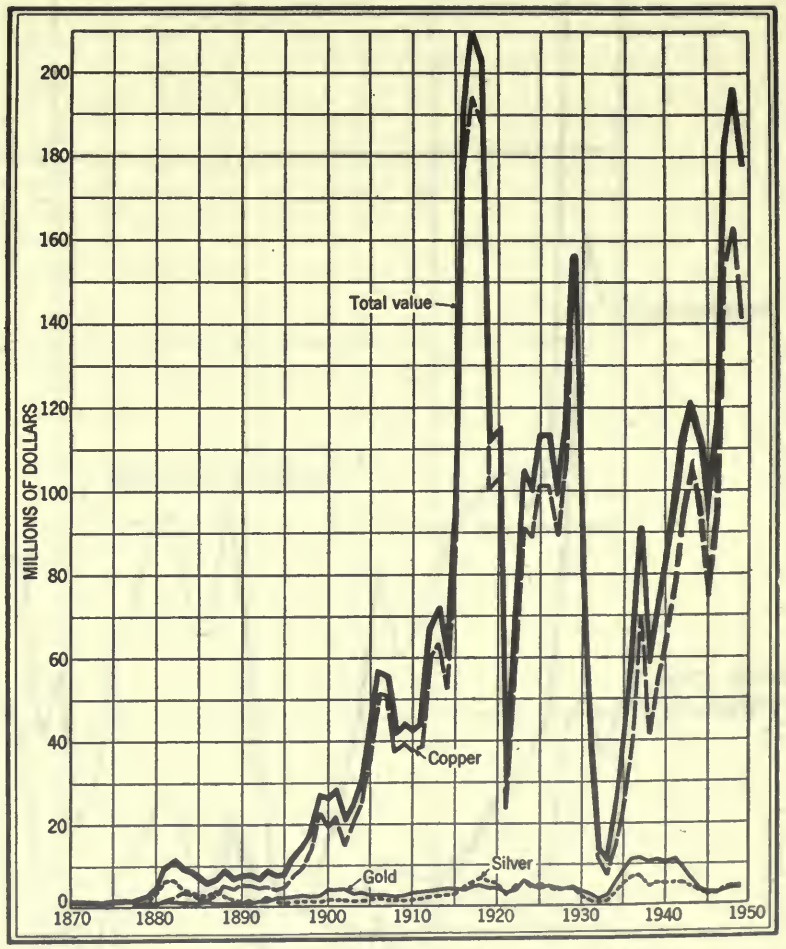


FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead, and zinc in Arizona, 1870–1949. The value of lead and zinc has been less than $2,000,000 annually, except in a few years.

Reprint from Bureau of Mines Yearbook, 1949

Chart BLM-W-D-82

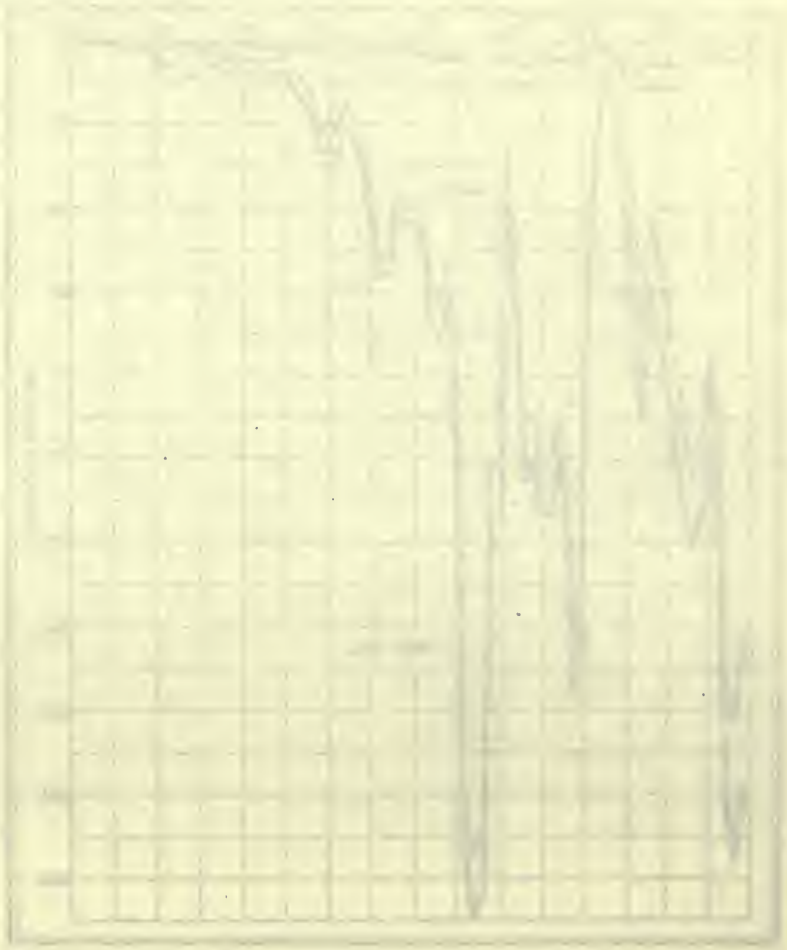
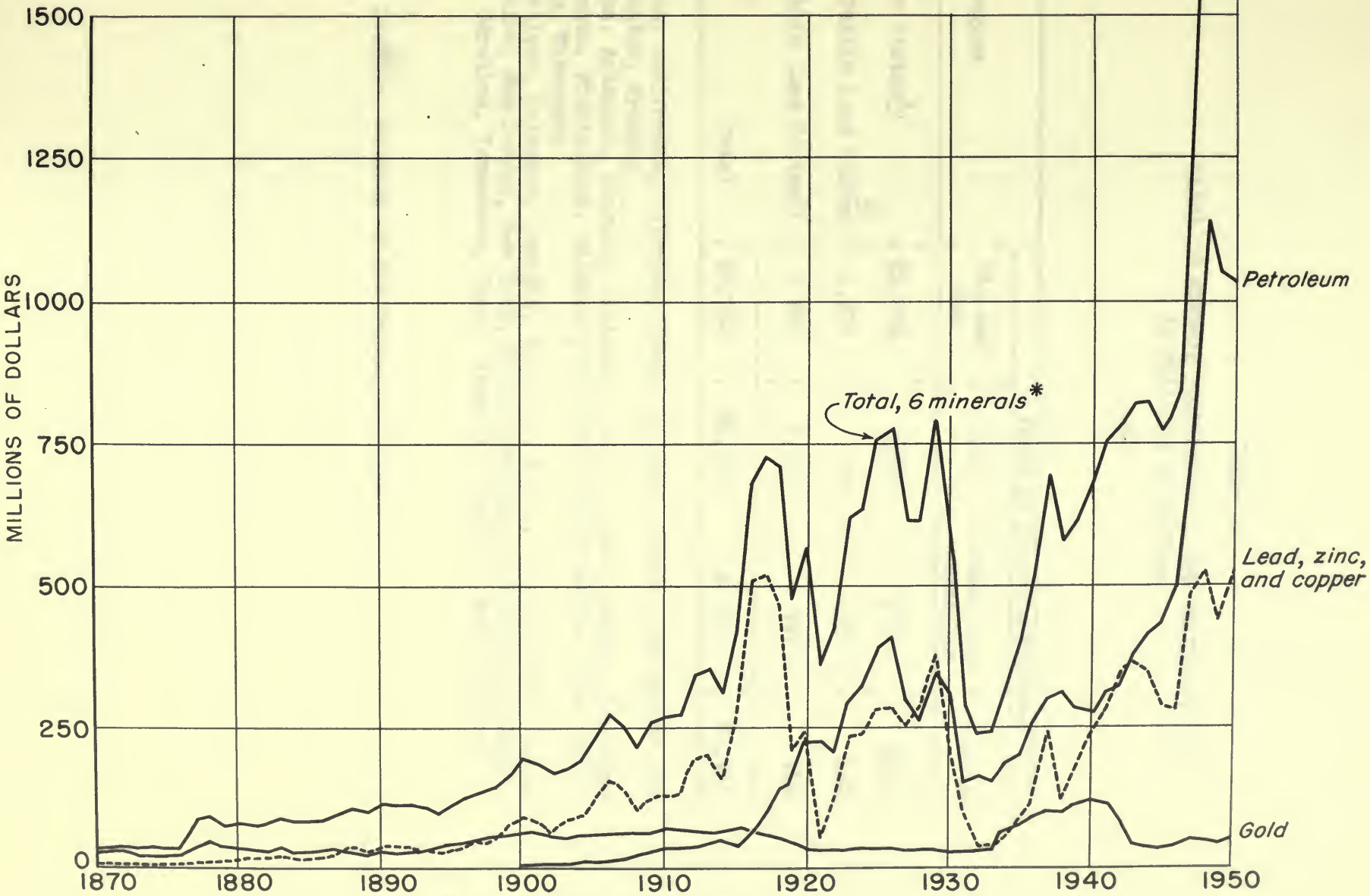


FIG. 6

VALUE OF SELECTED METALS AND PETROLEUM IN 11 WESTERN STATES, 1870-1950



* Those shown plus silver

Chart BLM-W-D-86

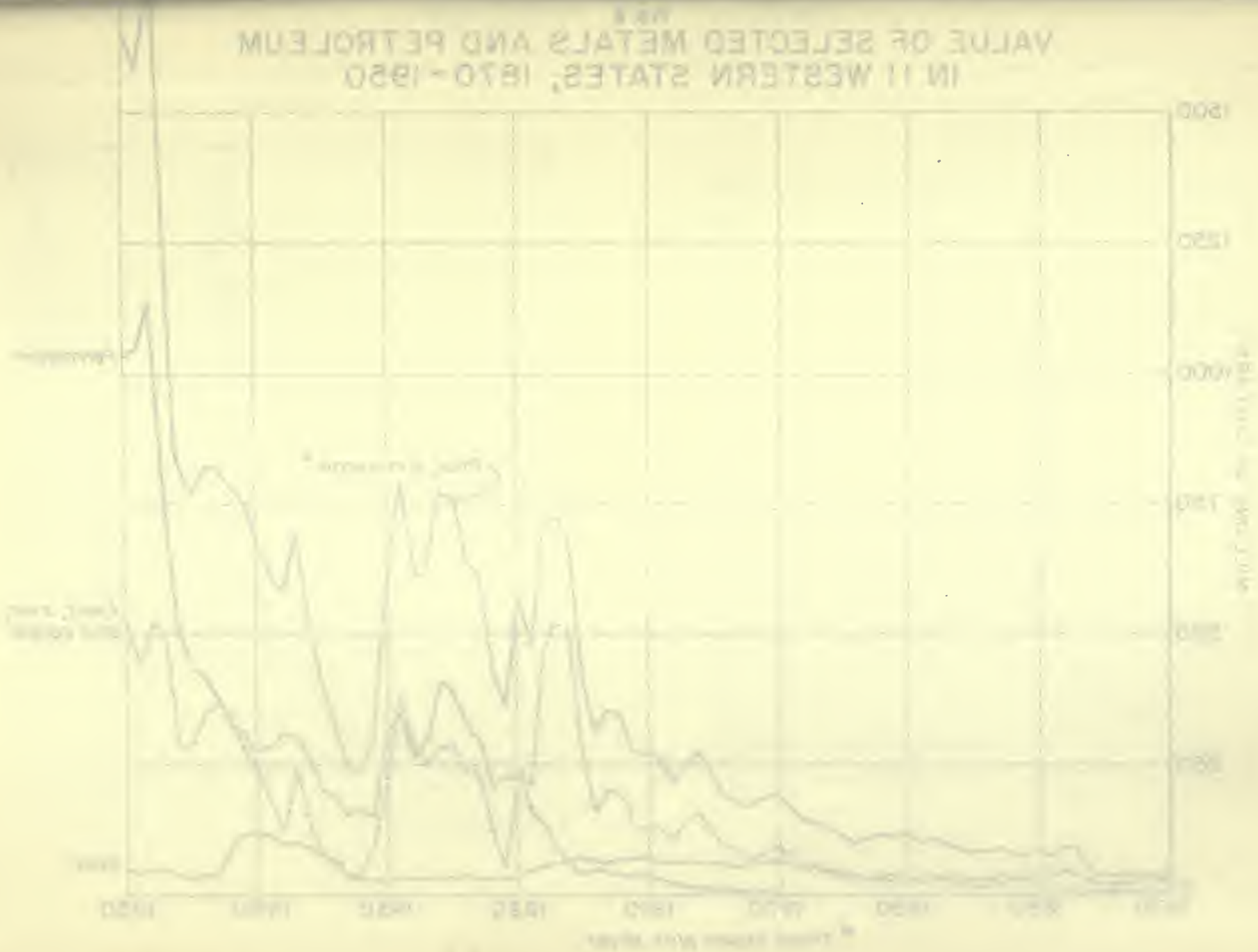


Table 3.

VALUE OF MINERAL PRODUCTION IN THE UNITED STATES
In Millions of Dollars

1950

Region	Value of Minerals Produced				
	Oil and Gas	Coal	Other Non-Metallic	Metallic	Total
11 Western States 1/	$1,896	$598	$738	$549	$3,781
18 Other Public Land States 2/	1,215	93	337	692	2,337
19 Non-Public Land States 3/	2,681	2,198	748	110	5,737
Total	$5,792	$2,889	$1,823	$1,351	$11,855

1/ Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming

2/ Alabama, Arkansas, Florida, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Wisconsin

3/ Connecticut, Delaware, Georgia, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia

Source: Records of the Bureau of Mines

TABLE 1.

[illegible] OF [illegible] [illegible] IN [illegible] [illegible]
IN MILLIONS OF DOLLARS

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

Farming

began in the West as soon as people arrived there--they had to farm, to eat. In the Southwest and in California, it long antedated other activities. Simple, and for subsistence only, at first, it has gradually developed. Irrigation by various forms of private and Government effort has added large areas of cropland. Wheat and other crops have expanded through dry-farming methods. Development of markets through better transportation to the East and through growing population in the West has provided an outlet for an increased volume of production. Acreage in crop expanded more or less steadily until roughly 1920; more slowly since. Output has risen steadily and at least as rapidly as population has increased. This has been accomplished primarily by intensification--more valuable types of production from the same areas. (See Figure 8). Fruits and vegetables have expanded more than, or even replaced, beans and grain; dairy cows have expanded more than, or even replaced, beef. (Table 4). Somewhat more labor, much more machinery, and much more fertilizer and other production materials have been applied to the same or slightly expanding crop areas, to produce greatly increased volume and value of output. Nearly all the agriculture has developed on lands once publicly-owned, although agriculture mostly did not begin until the individual at least began the first steps of transferring the lands to private ownership. The public land laws have been especially important to agriculture in the West.

Lumbering

for local use was an early activity in the West. Soon the areas accessible to tidewater began to be developed for the Eastern and export markets. With the construction of railroads, transcontinental and local, additional areas were opened up. The trend of total lumber output was upward in the United States until 1909, and in the West until the present. (See Figure 9). Per capita production of lumber reached a peak in the United States about 1909, in the West about 1929. In addition to lumber, pulpwood and plywood production has increased greatly, nationally and in the West, in recent years. Until recently, the prevailing practice was "Cut out and get out", so that local areas boomed and died. In addition to a

shift toward better forestry, the industry has shifted toward manufacture of more nearly finished products, and more diversified products, in the West. While it is impossible that total wood fiber output can expand as rapidly as population grows, more intensive manufacture and utilization may keep lumbering employment at a relatively constant fraction of total employment in the West. All lumbering has been on lands once or yet publicly-owned; most of the cut thus far has been on lands once publicly-owned but privately-owned at the time cut. There has been extensive timber cutting in trespass on public lands, though perhaps less so than in either Lake States or the South. At present, nearly 40% of all commercial timber in the United States is Federally-owned; in the West, nearly 60%. (Table 5). However, only 11% of the total volume of timber cut Nationally, and only 17% of the timber cut in the West, come from Federal land.

Diversified industry

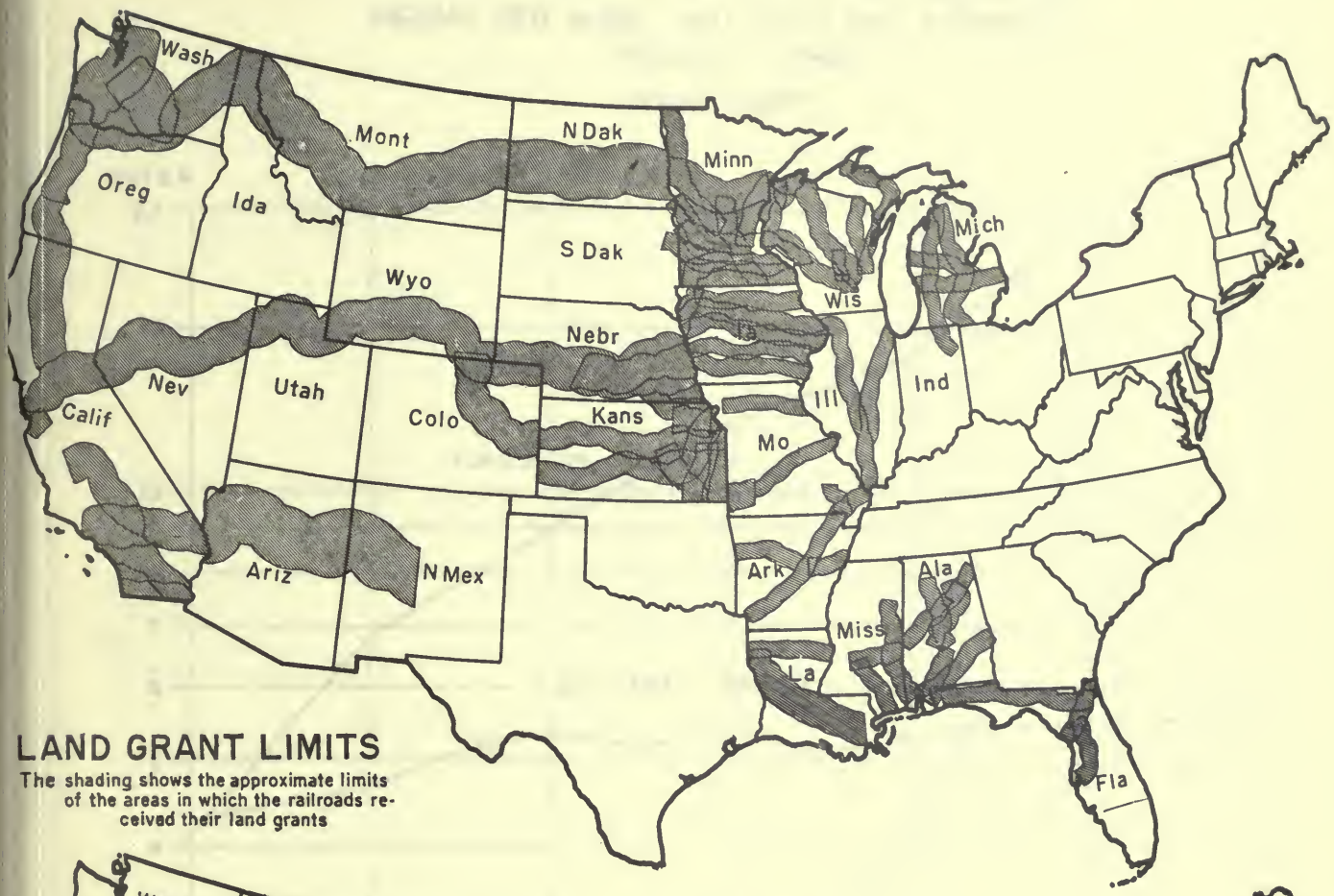
has come to the West more recently than the foregoing economic activities. Some industry is necessary to serve consumers locally, and this began as the West was settled, and has expanded since. Some minimum processing is often necessary near the source of raw materials, and the West has had that. However, as in the case of forest products, the amount and nature of local processing of the same volume of raw materials has increased greatly in recent years. "Footloose" industries are those whose location is dictated neither by local consumers or local raw materials, but may be anywhere. Expansion of such industries has been particularly great in the West in the past three decades. While some of their materials may have come from land now or previously publicly-owned, the greatest significance of such industries, as far as the present purpose is concerned, is that they have helped build a greater total economy, and total population in the West and, hence, indirectly, demand for the public lands.

Irrigation, hydroelectric power, and new metal industries

have increased together in the past two decades, as a result of large scale river development programs. Irrigation works can no longer be simple and inexpensive, but must include major dams. These in turn can provide flood control and other benefits, as well as large quantities

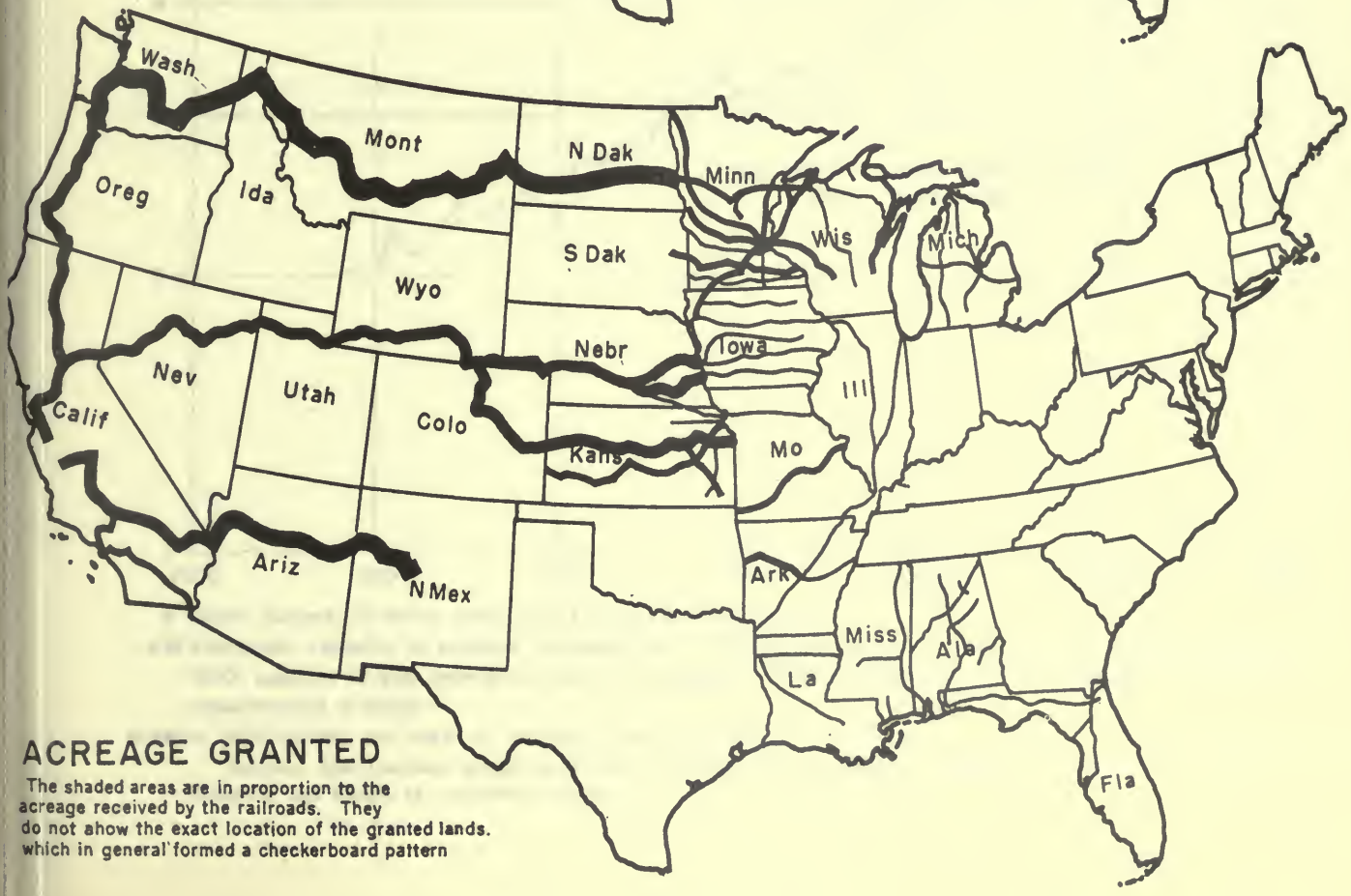
FIG. 7

FEDERAL LAND GRANTS FOR RAILROADS



LAND GRANT LIMITS

The shading shows the approximate limits of the areas in which the railroads received their land grants



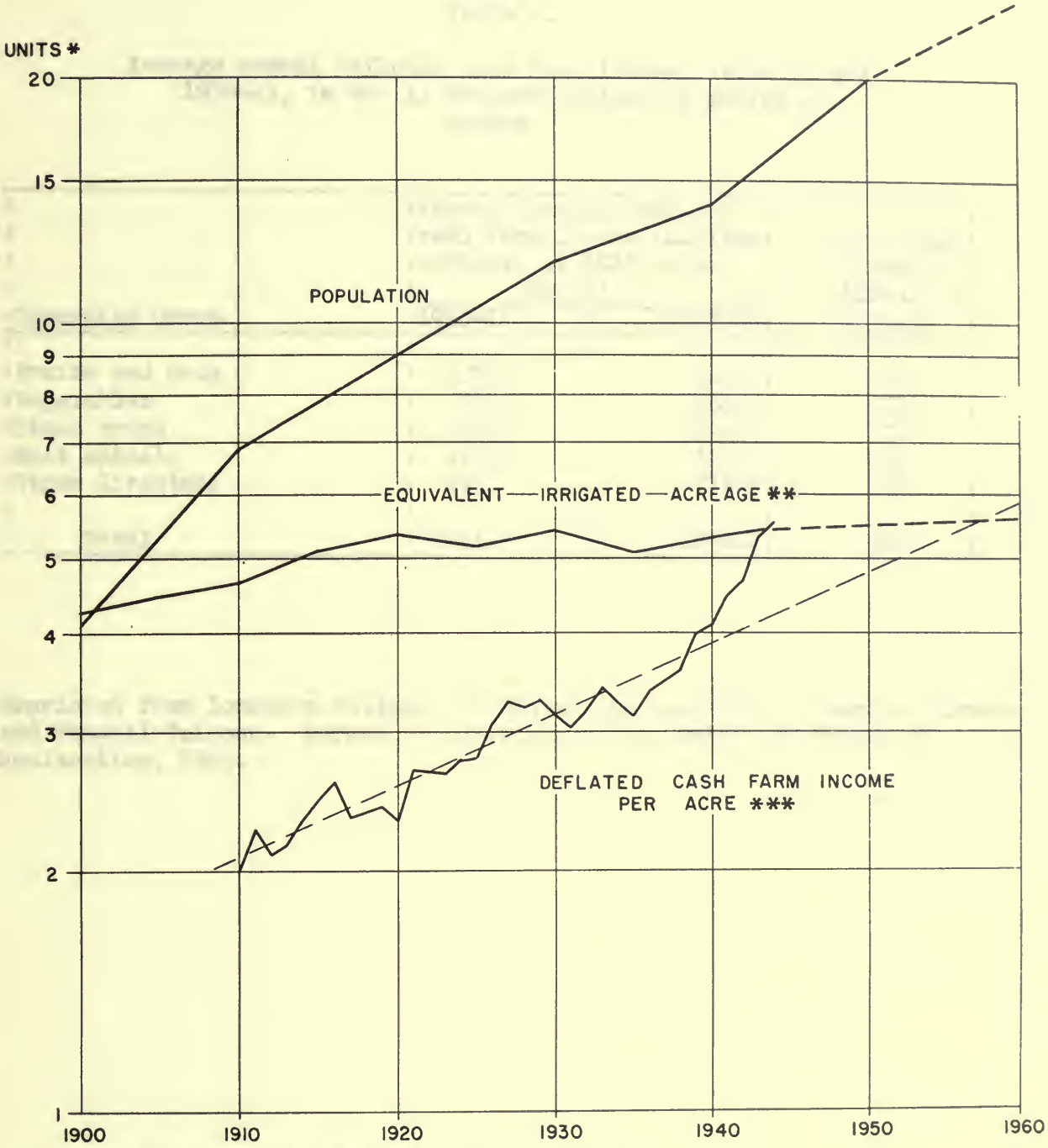
ACREAGE GRANTED

The shaded areas are in proportion to the acreage received by the railroads. They do not ahow the exact location of the granted lands. which in general formed a checkerboard pattern

FIG. 8

ELEVEN WESTERN STATES: POPULATION, EQUIVALENT IRRIGATED ACREAGE, AND DEFLATED CASH FARM INCOME PER ACRE, 1940-1944 AND ESTIMATED TRENDS TO 1960

(RATIO CHART)



* Million persons, 10 million acres, and $10 cash income per acre.

** Equivalent capacity to produce livestock feed, of grazing land, dry land cropland, and irrigated land. For 1945-1960, assumes 10 year development period for authorized projects, followed by a 10 year development period for nonauthorized projects.

*** In 1926 dollars, per acre of irrigated land equivalent.

Reprinted from Longterm Outlook for Western Agriculture, by Marion Clawson and Wendell Calhoun, Bureau of Agricultural Economics and Bureau of Reclamation, 1946.

Chart BLM-W-D-78

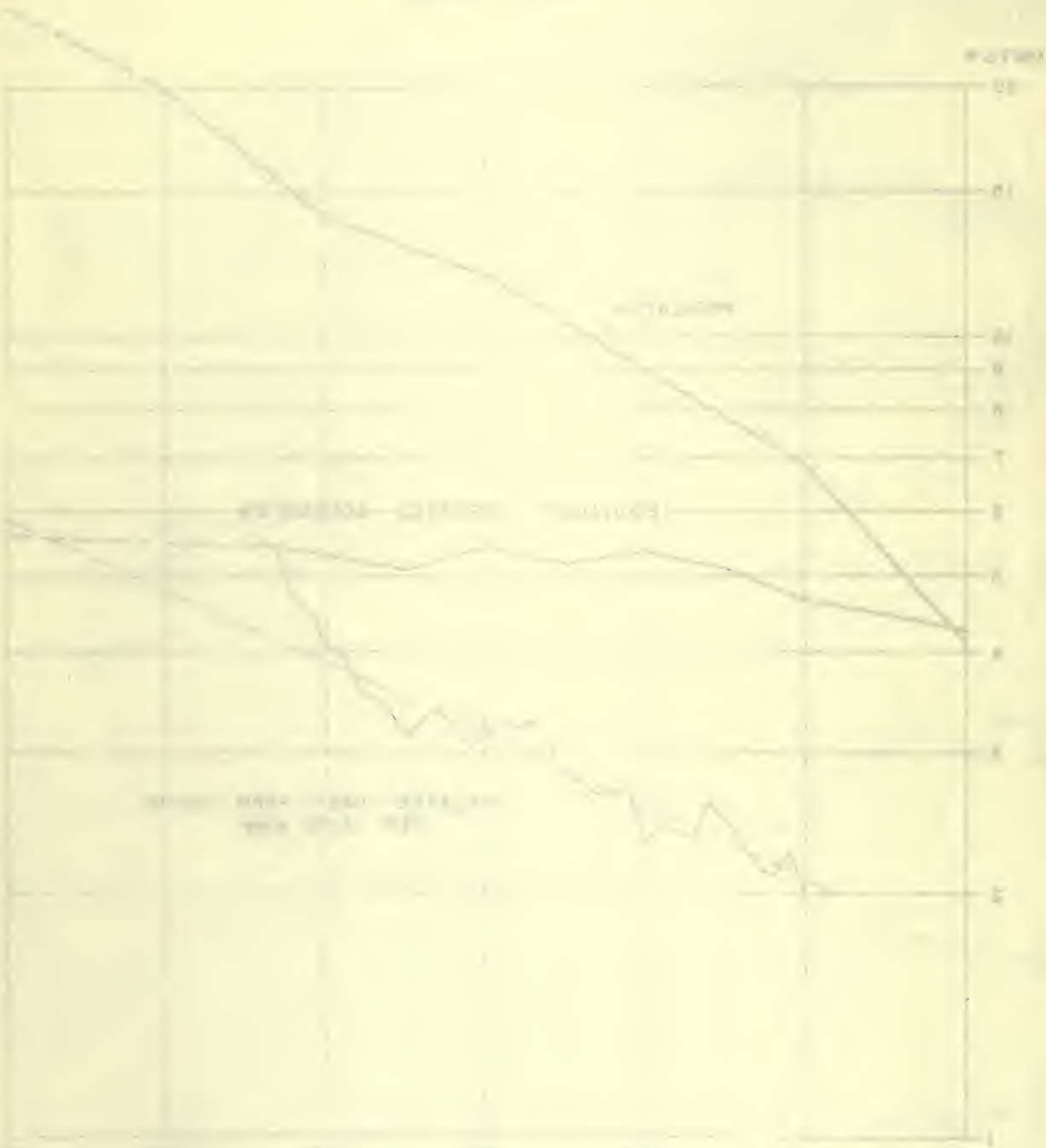


Table 4.

Average annual deflated cash farm income, 1910-14, and 1939-43, in the 11 Western States, by source of income

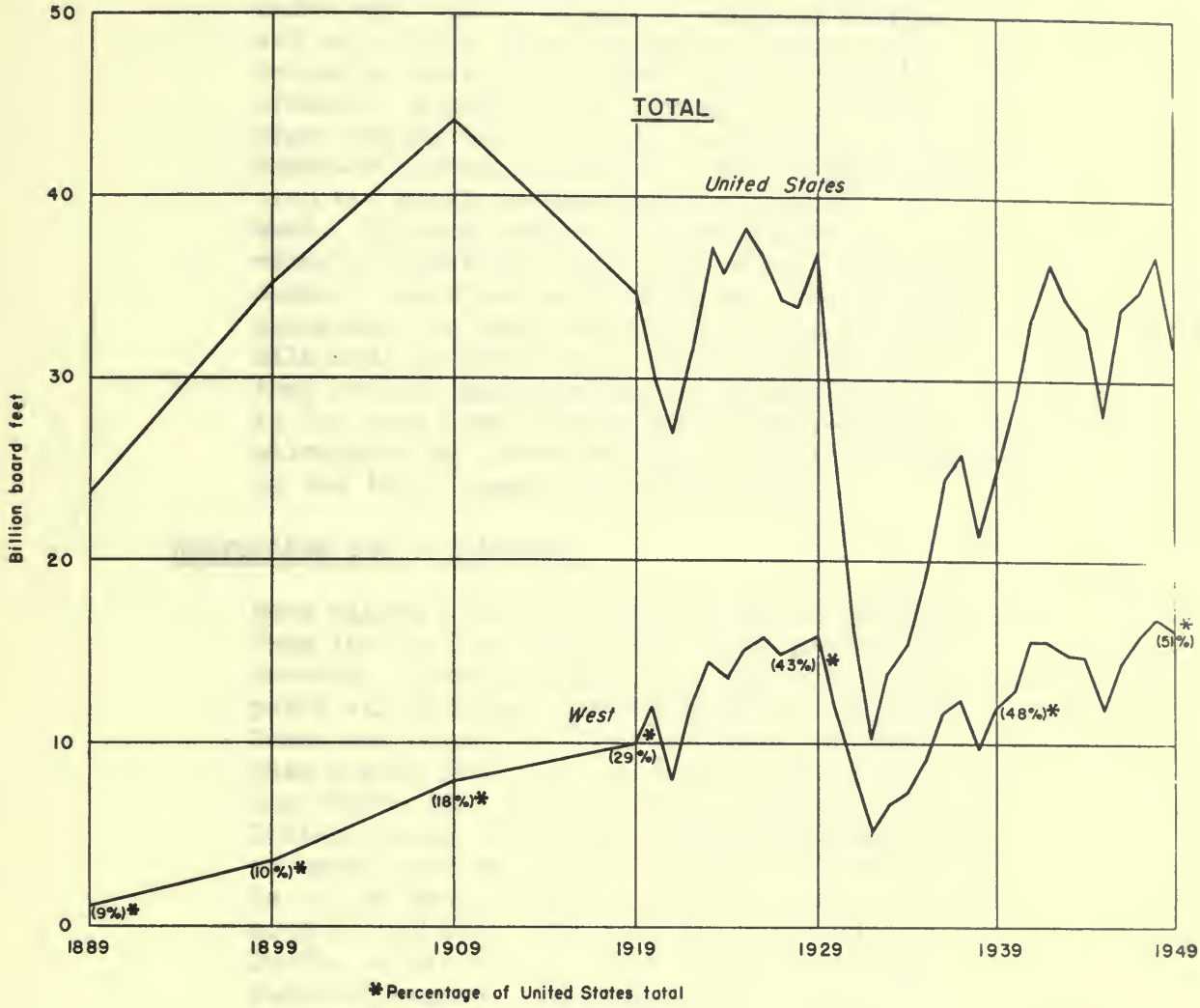
Commodity Group	Average annual deflated cash farm income (million dollars, at 1926 price level) 1910-14	1939-43	Percentage increase 1910-14 to 1939-43
Fruits and nuts	170.2	423.5	149
Vegetables	71.2	264.5	271
Other crops	310.2	533.0	72
Meat animals	319.3	512.7	61
Other livestock	173.3	516.5	198
Total	1044.2	2250.2	115

Reprinted from Longterm Outlook for Western Agriculture, by Marion Clawson and Wendell Calhoun. Bureau of Agricultural Economics and Bureau of Reclamation, 1946.

Table 2

Percentage [illegible] [illegible] [illegible]

FIG. 9
LUMBER PRODUCTION IN SELECTED YEARS,
UNITED STATES AND WEST, 1889 TO 1949



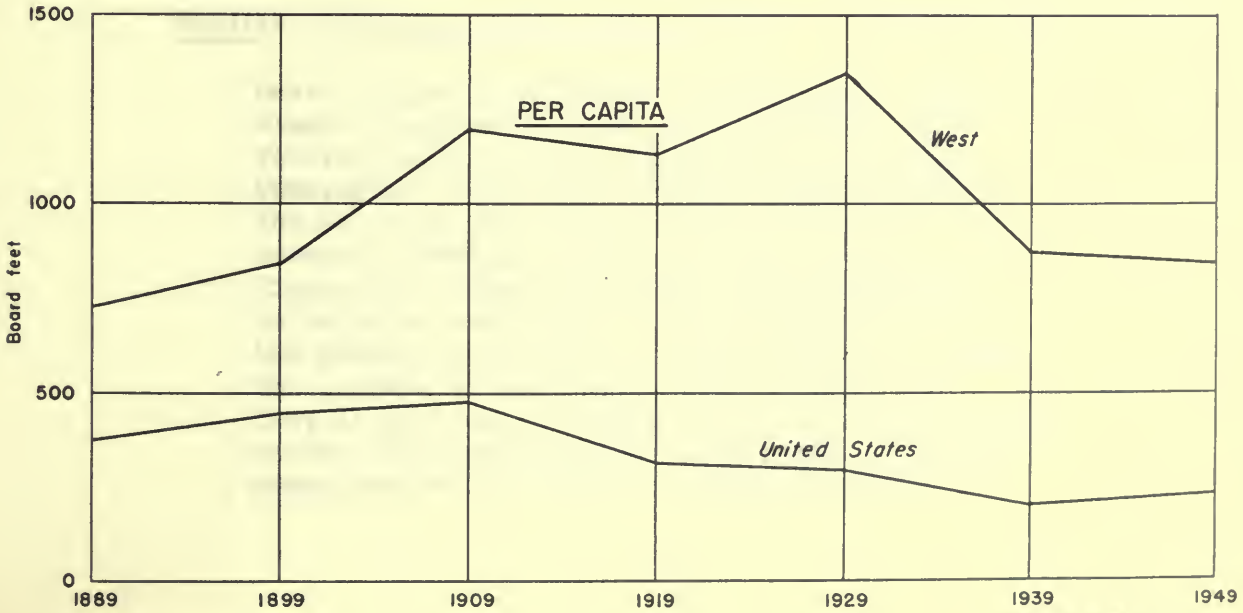
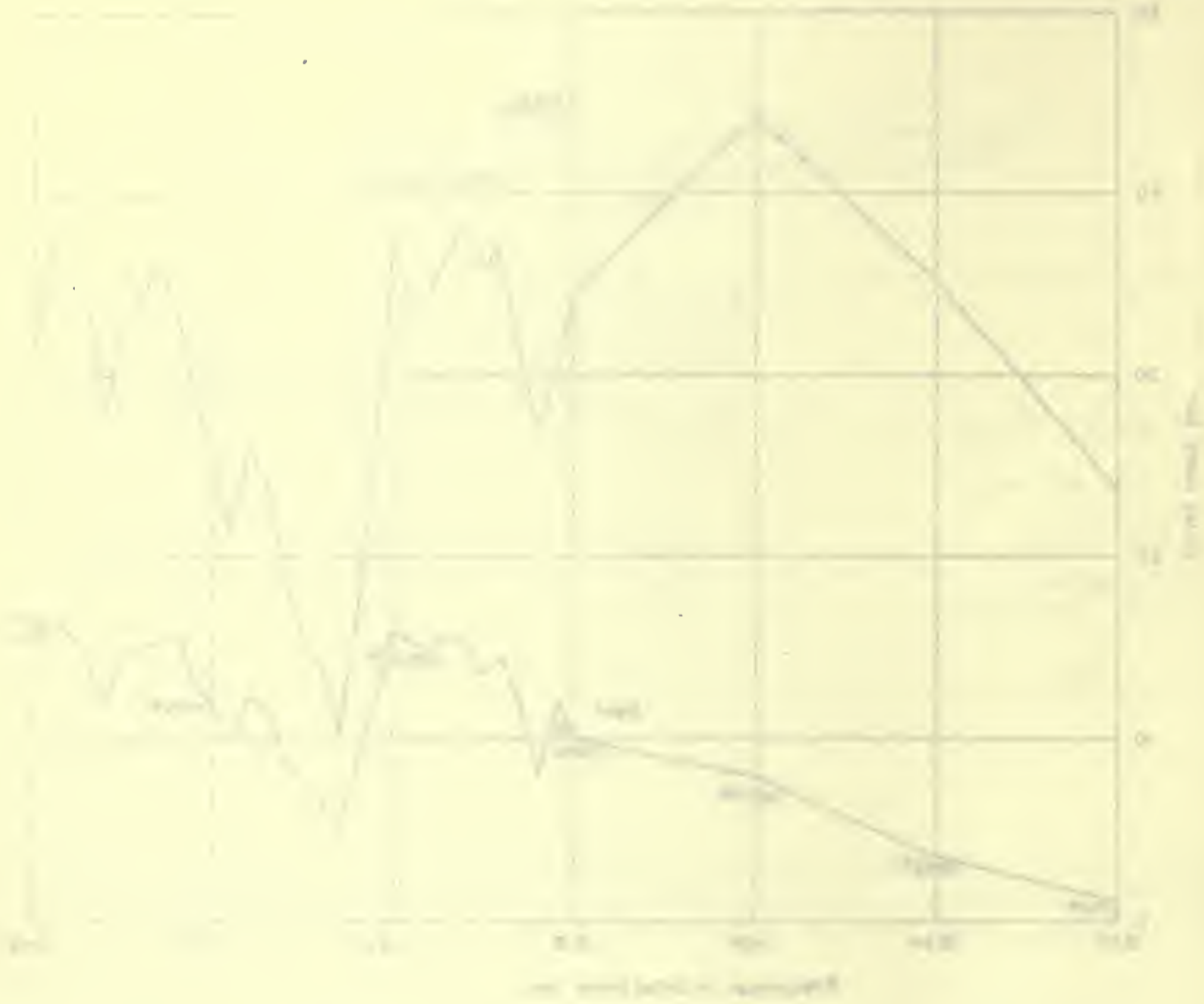


Chart BLM-W-D-79



of hydroelectric power. However, Grand Coulee, Bonneville, Shasta, and many other major dams have been built since 1928, and others are under way. Total output of electric energy, and especially of hydroelectric energy, has increased much faster than population has increased. Aluminum and magnesium production began immediately prior to World War II, and expanded greatly during it. At the same time, iron and steel production rose sharply in the West. To some extent, the necessary raw materials came from land now or once publicly-owned. There are major problems of watershed management on the areas behind these big dams. Silt must be kept out of the reservoirs, if they are to remain productive permanently. At the same time, the economic development stimulated by these dams has added indirectly to the total demand for public land.

Recreation and sightseeing

have always been major activities in the West, from the earliest explorer to the present day tourist. Total number of visits to national parks and national forests have multiplied by leaps and bounds in the last three decades. (See Figure 10). It has been estimated that one-fourth to one-third of all persons in the United States visit some Federally-owned land or water area each year. While not all of this is in the West, tourists are big business for much of the West. Most of this activity is on land once part of the public domain and yet Federally-owned. There has always been some recreation interest in the public domain, and this has increased greatly in recent years.

Popular attitudes toward public land

have changed greatly over the decades. Once, almost everyone assumed and wished that all Federal land would be transferred to private ownership. First the national parks and then the national forests were established as permanent Federal land management areas. (See Figure 11). Some lands unwisely transferred to private ownership have been bought back by the Federal Government. (See Figure 12). With the passage of the Taylor Act in 1934, the last large area of Federal land was brought under constructive management. (See Figure 13). The preponderant sentiment of the Nation today is

for permanent retention in Federal ownership of most land now Federally-owned, although there are naturally some divergent views on the subject. The era of wholesale disposal of Federal land has passed; the era of management and development is here. Selective disposal of some tracts that cannot be managed efficiently by a Federal agency, and of others that will have a higher use and value in private than in public ownership, is desirable. Lands remaining in Federal ownership must be improved and developed as far as economically feasible; they have been, are, and will continue to be, fully used by private persons and groups.

PRESENT SIGNIFICANCE OF PUBLIC LANDS IN THE WEST

Public lands are important

in the economy of the West and of the Nation. Resources from public lands are harvested by private enterprise, and the public lands are fully used by private individuals. In fact, under the multiple-purpose management of most Federal areas, there is more use of these lands for more purposes than is probable under private ownership. Public lands do not stand apart from the rest of the Western economy; they are an integral part of it. The following sections will show how livestock and game grazed most of the year on other land find their feed at one season on public land; how forest and mineral products from public land add to the supply from private land, etc. Since the public lands are significant to the Western economy, they are also important to the National economy, since the West is closely integrated with the rest of the Nation.

Game animals

and other wildlife live on or find their feed from public lands, either throughout the year or at certain seasons. In many localities, game animals winter on public lands and intermingled lands of other ownerships. The amount of winter feed available often limits total numbers of game animals. Land now used for farm and ranch crop production was once winter game range, and its use for these purposes has reduced the available winter game grazing. Game animals have increased greatly in numbers in recent decades; in many localities, there is more game than the available feed will support.

Table 5.

Volume of commercial standing timber and volume cut, 1950, United States and 11 Western States, in total and for Federal land

(Billion board feet)

Area	Commercial standing timber		Timber Cut	
	Total	Federally-Owned	Total	From Federally-owned land
United States	1600	622	42	4.8
11 Western States	1042	594	22	3.7

20690

FIG. 10

NUMBER OF VISITS TO NATIONAL FORESTS, PARKS, AND MONUMENTS 1924 to 1951

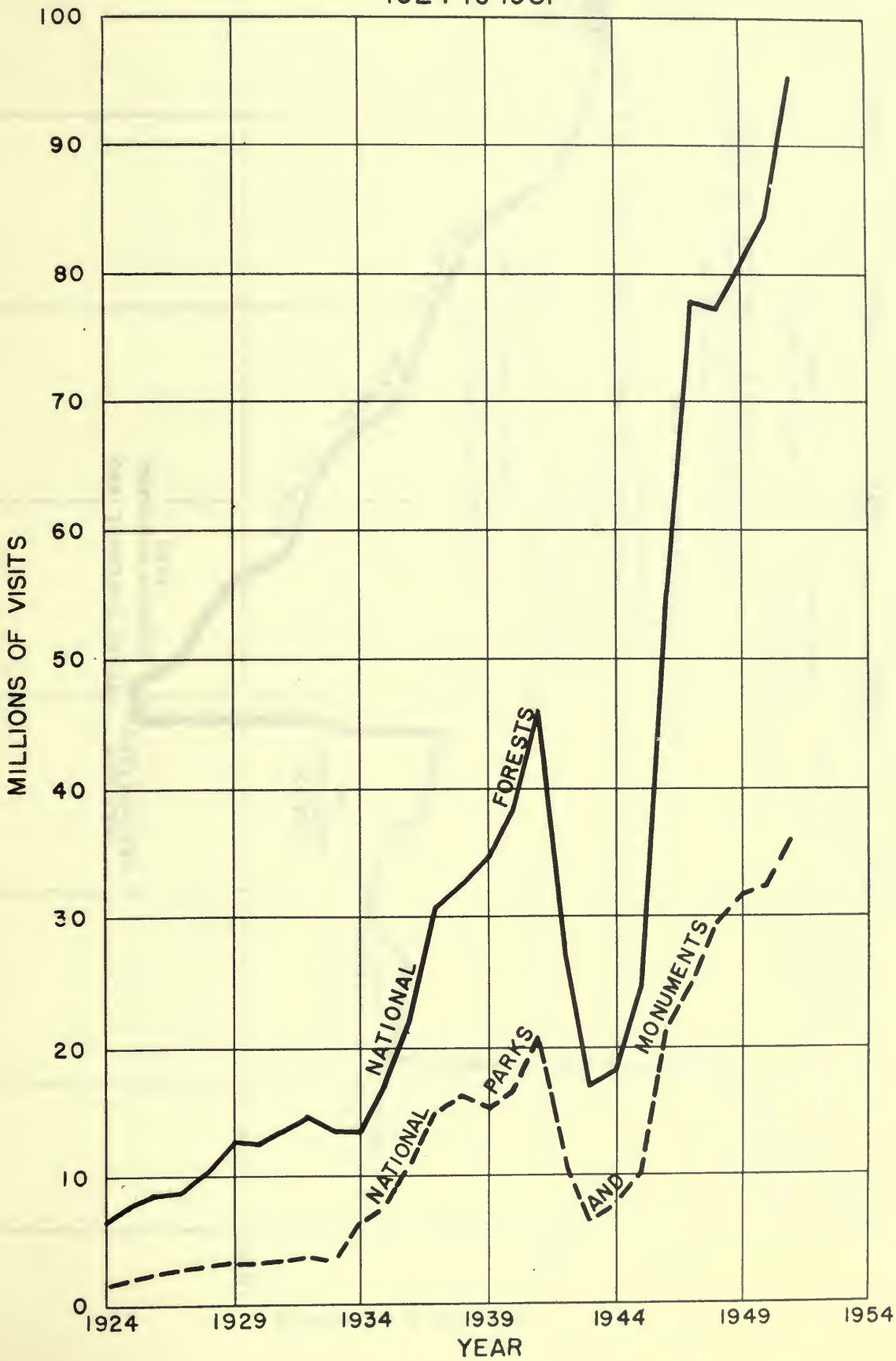
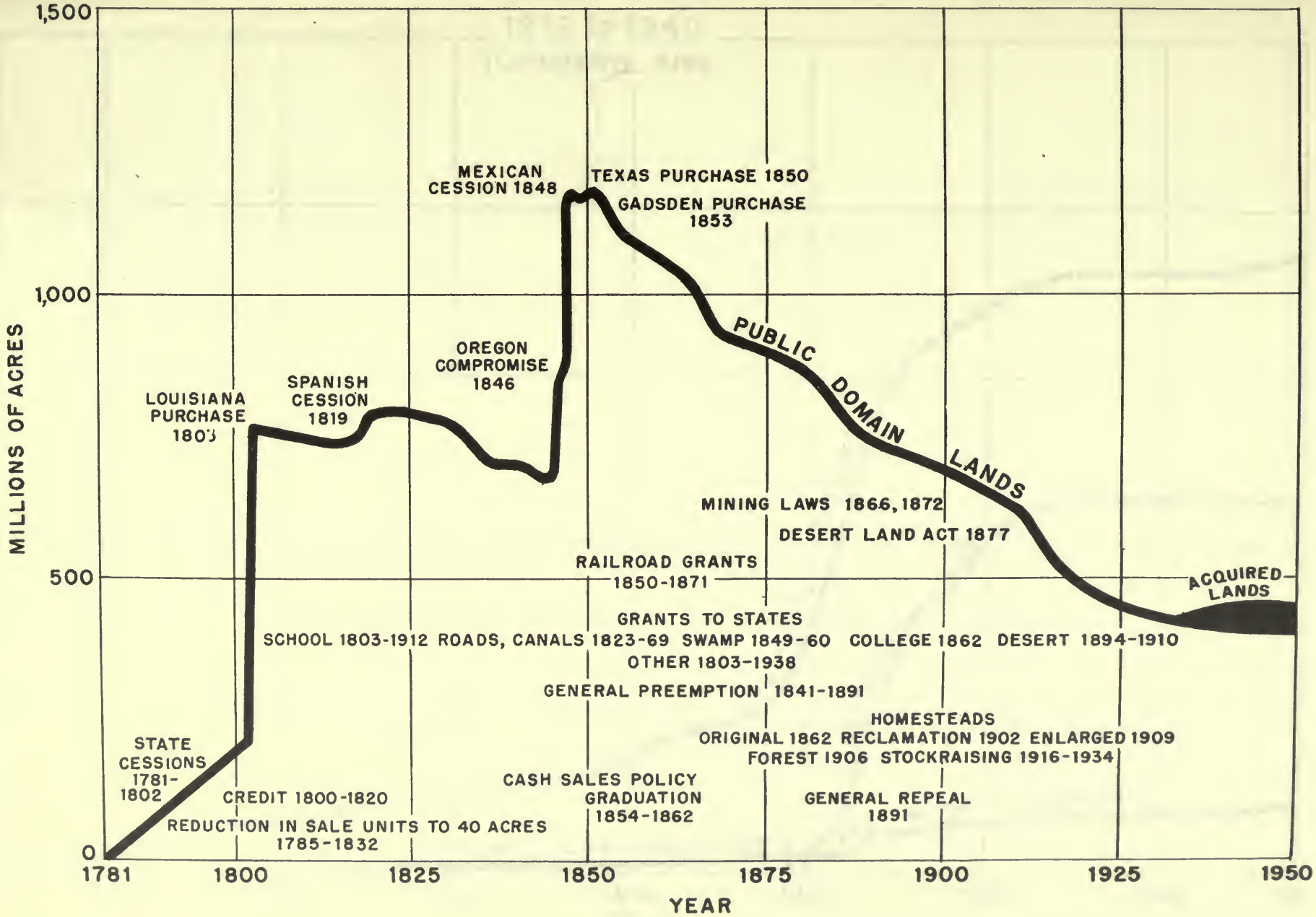
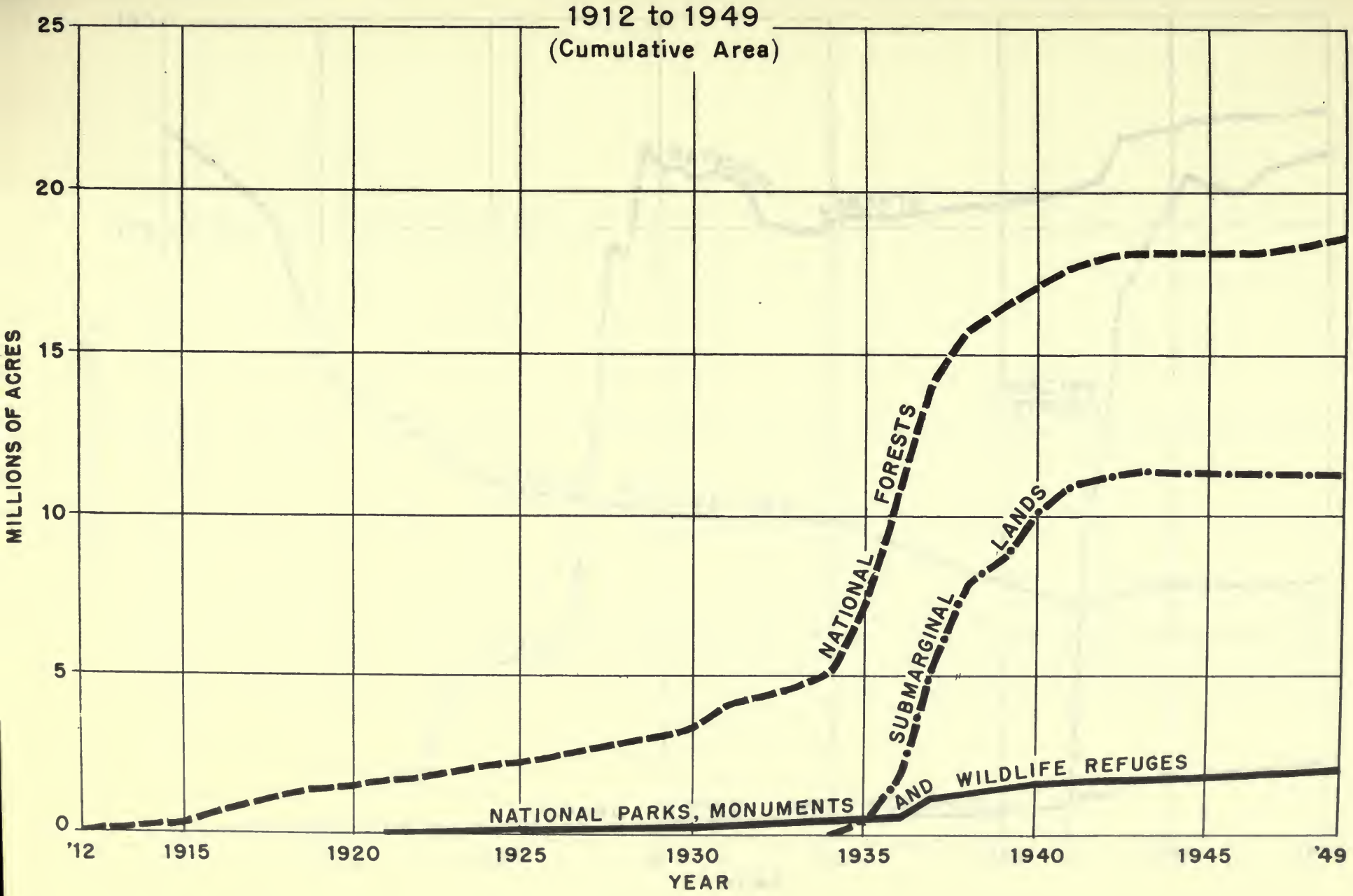


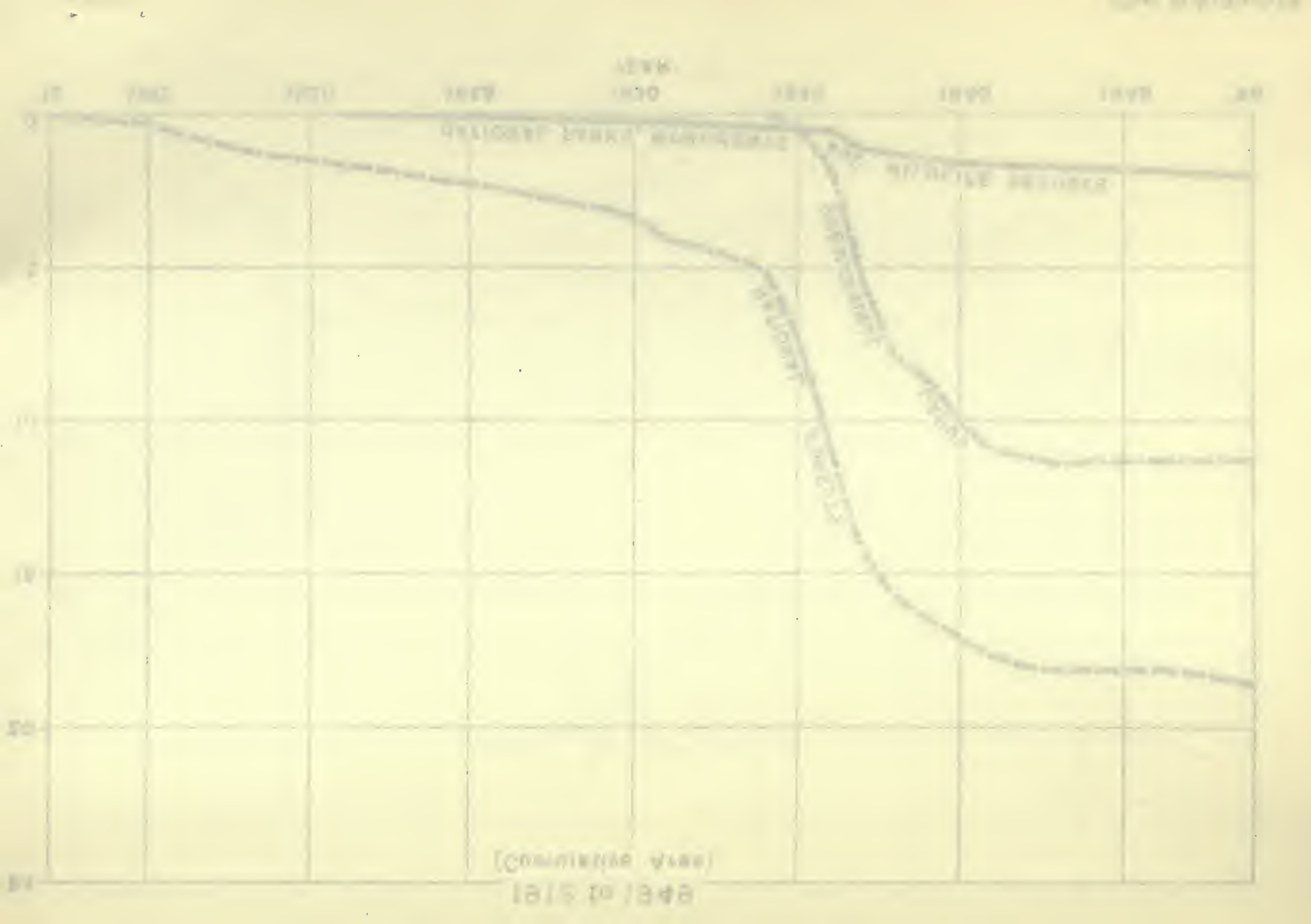
Chart BLM-W-LR-46a

WITH DATES OF IMPORTANT ACQUISITIONS AND LAWS

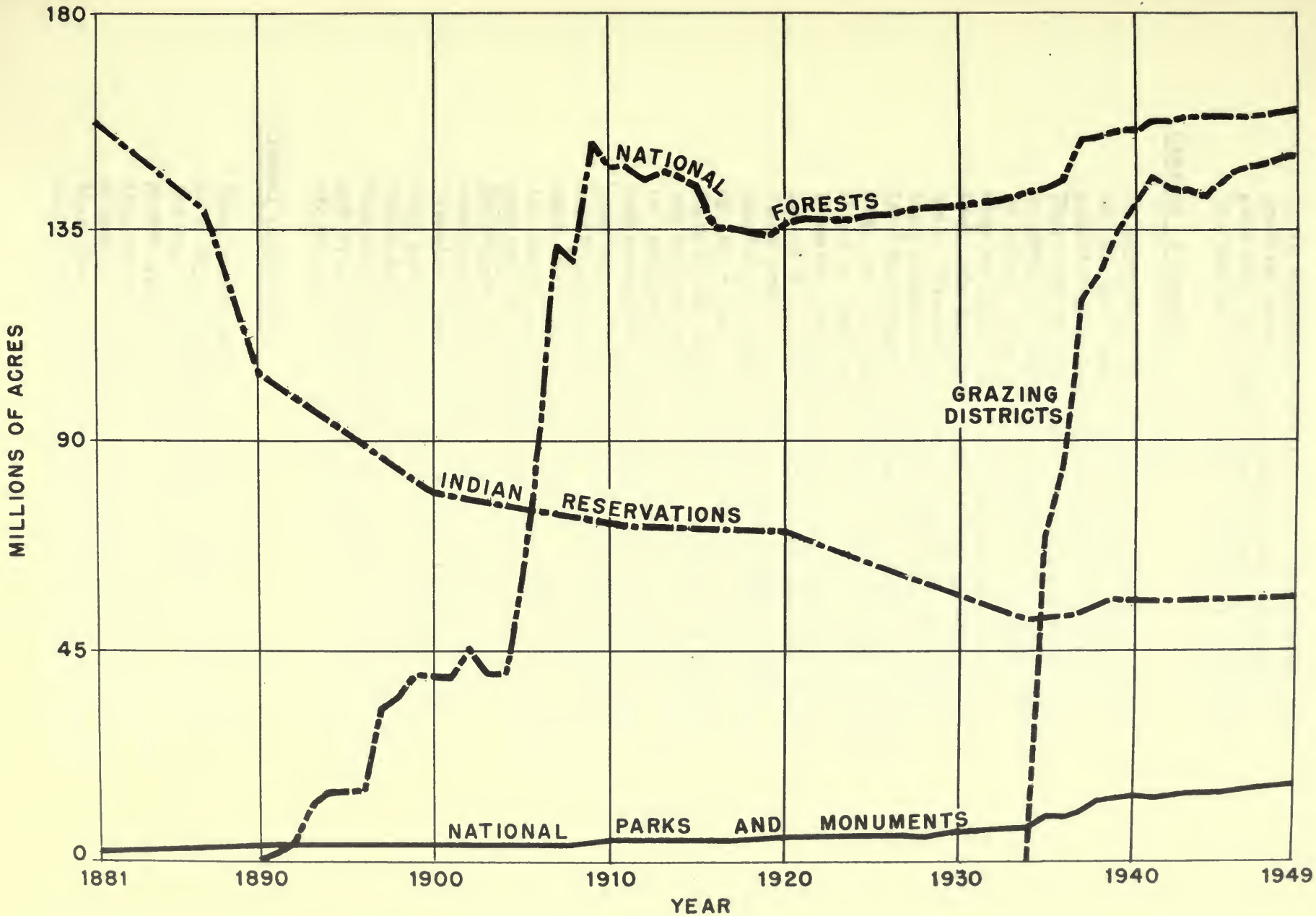


MAJOR LAND PURCHASES BY FEDERAL CIVILIAN AGENCIES





NET AREA OF MAJOR FEDERAL RESERVATIONS IN THE STATES
1881 to 1949



It is significant that, in administration of grazing districts, allowances of forage for game are made before any allocation of grazing to ranchers is given for domestic livestock.

Grazing by domestic livestock

is carried on on perhaps 175.6 million acres, out of the total of 186.5 million acres administered by the Bureau of Land Management. There are 20,000 licensees and permittees within grazing districts, and 12,000 grazing leases in effect outside of districts. Perhaps as many as 48% of all livestock producers in the West, who use range land of any ownership in their livestock production system, use public land under the jurisdiction of the Bureau of Land Management. A total of roughly 16 million AUMs is obtained from these lands, or about one-third of the annual feed requirement for the livestock which graze upon these lands. Perhaps 12% of all feed required for all Western livestock produced by use of some range, of any ownership, comes from public lands administered by the Bureau of Land Management. These figures may appear small. However, as someone has pointed out, the carburetor of an automobile is less than 1% of its total weight but is indispensable nevertheless. One month's spring grazing, of relatively poor quality, is only a small percentage of the total annual field requirement, but this grazing may be indispensable in the annual operations. Public ranges are mostly seasonal in usefulness; in practically no instances are they usable alone, but must be combined with private land to form efficient livestock producing units. At the same time, they are often critical to livestock operations. Since such a large percentage of certain seasonal ranges is public land, the amount of grazing on it may often be the limiting factor for total livestock operations in a locality.

Mineral production

from public lands is not now large but this may be a major source of mineral production in the future. Public lands contribute 96% of annual potash production, 1% of phosphate, 5% of oil and gas, as well as small amounts of other leasable minerals. No data are available on metal production from public lands, but the amounts are surely small, since all large producers are patented and

hence no longer public land. Public lands are particularly important as a possible source for future mineral production. Our rapidly expanding industrial economy requires more and more minerals; new sources will be required. Minerals are exhaustible, not renewable, resources; once taken out, they are gone permanently from that location. Although the minerals easily found on public land have nearly all been found and taken to private ownership, great possibilities remain for finding concealed deposits. New techniques of exploration are resulting in discoveries of previously unsuspected deposits. The number of discoveries will probably be small in the future, but discoveries will average larger, and require more capital and more technological skill to exploit, than in the past.

Crop production possibilities

on the public lands are meager. Nearly all land capable of successful continued crop production has long since passed to private ownership. There are a few desert valleys where groundwater supplies may permit irrigation; new irrigation projects may irrigate a little public land, although most land in such projects is already privately-owned; and, here and there, an occasional homestead can be allowed. With these minor exceptions, there are no possibilities for crop production from present public land. There is no present crop production from public land.

Forestry

on public lands is important now and likely to become more so in the future. Of all potential forest and woodland in the United States, 33 1/3% is in Federal ownership, and 7% under the jurisdiction of the Bureau of Land Management. Of presently commercial saw timber, 39% of the total volume, and 16% of the annual cut is on or from all Federal lands; for lands under the Bureau of Land Management, 5% and 1.4%, respectively. For the West, these figures are very much higher, and for some localities, the Bureau of Land Management or other Federal timber may be the dominant source of supply. At present, commercial timber is being cut from private lands faster than it is being replaced by young stands reaching commercial size; on Federal lands, including those under the Bureau of Land Management, annual cut is roughly 50% of sustained-yield capacity. In some areas, almost the only source of timber

available to the mill owner who does not own his own timber, is Federal timber. Timber under the Bureau of Land Management and other Federal agencies is a vital and integral part of the Western forest products industry; it could play an even more important role, given adequate appropriations, to permit sale of full sustained-yield cut. Changing technology has given value to previously unused species--i.e., white fir for box shook, lodgepole pine for lumber and pulp, etc; and further developments in the future may well make valuable species not now used--pinion pine for pulp, etc.

Watershed values

on public lands are important now and almost sure to become more so in the future. As streams become more fully developed on a multiple-use basis, the maximum yield of water and the minimum movement of silt become increasingly important. Watershed management is in its infancy; thus far, our programs have mostly been designed to prevent undue disturbance to native or natural conditions. In general, the high mountain areas of the West, many of which are in National forests, produce most of the runoff and little of the silt that gets into major streams such as the Colorado, Rio Grande, and Missouri. The land at lower elevations, a large part of which is in grazing districts, produces much less runoff but a large part of the total silt reaching the major stream channel. On several Western streams, the area which produces 80% of the runoff produces but 20% of the silt, and, conversely, the area that produces 20% of the runoff provides 80% of the silt. Misuse, over-use, and uncontrolled use have aggravated natural hydrologic and erosion situations; planned and managed use, plus positive rehabilitation measures, will materially improve the present situation. Water and silt are related factors but of opposite value. The real problem is to increase usable runoff, which may mean to increase total runoff, and surely means to decrease silt movement. Water is becoming increasingly valuable in the West.

Recreation and general public use

of public lands is now important. The "wide open spaces" are part of the appeal of the West. The heavy demand for small tracts on the desert, for

winter vacation spots, is indicative of popular demand for public land. Though the lands under Bureau of Land Management jurisdiction are mostly not the choicest for recreation, their existence and their availability gives them value.

WHAT OF THE FUTURE?

Obviously, no one knows what is going to happen in the future; but a consideration of past trends and present situation may lead to some reasonable estimates of factors and situations likely to be important. As far as the public lands are concerned, the following seem most important:

Continued rapid growth of the economy

of the West and of the Nation seems probable, even certain. Population will increase, and per capita output and consumption rise. The only real question is, how much? Any estimate can readily be challenged. To this writer, the danger is that we will underestimate future growth potential--virtually every past study has underestimated what has actually happened.

Resultant heavy pressure on natural resources

is a corollary of the anticipated increase in population and economic activity. All types of raw materials will be in heavy and growing demand. Well-known resources will be in increased demand for old and familiar purposes, and probably for new purposes as well; and presently unused resources may come into heavy use. High demand and developing technology will tend to put pressure more or less equally on all resources, through substitutions. This heavy demand for natural resources will affect all resources, regardless of ownership.

Special pressure on public land resources

seems probable, for several reasons. In the first place, the region of the United States--the West--where economic growth is the highest is also the region where most of the public lands lie, and where a substantial part of all natural resources are on public lands. Mere proximity will make for heavier demand on resources of public lands. In the second place, the resources of the public lands were often not in demand at an earlier date--the reason the lands are still Federally-owned is that no

one wanted them under the terms they were then available for. While the demand for and price of the highest grade natural resources increase as population grows and the economy expands, percentage-wise the greatest effect is exerted on the resources previously unused and unusable but now in heavy demand and economic to develop. Remote and thin stands of timber, sparse and poorly watered grazing areas, and low-grade ore deposits alike become usable and valuable as demand increases beyond the capacity of the better grades of resources. The pressure on all natural resources is likely to fall with special force on the resources of the public lands.

Demand for minerals

from public lands may prove to be especially important. The United States is gradually becoming less self-sufficient in minerals, and many older deposits cannot be worked indefinitely or at any desired volume of output. New deposits of many minerals are urgently needed now, and will be needed even more urgently in future decades. Some analysts believe the public lands offer the greatest possibilities for finding large new deposits of important minerals. Even if such deposits exist, their development will require extensive and expensive exploration and also expensive development programs after discovery. There are large areas of the West covered by deep fill, under which may lie as rich ore deposits as those found on the surface. By and large, the remaining public lands have not been as thoroughly explored by the most modern methods as have most privately-owned lands.

Revolutionary technological developments

should not be ruled out. Such things are obviously impossible to predict long in advance. At present, methods for artificially-induced precipitation and for purification of sea water are possibilities for widespread practical use. Should they develop to this extent, their practical effects on public lands would be very great. Underground gasification of the extensive coal deposits on public land might produce energy so cheaply as to shift the whole industrial picture. These particular developments may never occur; others may or may not occur. One has only to recall the whole atomic

development of the past two decades to realize that no one can predict what may happen, or what the impact on public land resources may be. Any look at the future should simply include a caution about wholly new and revolutionary forces.

BLM'S MAJOR PROBLEMS TO MEET ITS GOALS

Accurate land status and adequate cadastral surveys are needed.

To do a competent job of administering publicly-owned natural resources, the agency responsible should know, as an absolute minimum, what lands it is responsible for. This requires, at the very least, accurate land status records and adequate cadastral surveys to mark boundaries on the ground. BLM has neither. Our records are old, physically deteriorating, hopelessly inadequate in conception for modern conditions, and full of errors. Much land has never been surveyed, and on other large areas the old surveys are useless or worse. We are in the position of a merchant without the slightest idea of the merchandise on our shelves or in our stockroom. Complete revision of basic land records, starting anew from original sources of data, and sharply accelerated survey and resurvey programs are essential. They will cost money, but in the end save money.

Accurate inventories of land are equally essential.

Once our records will show accurately what land is public, and our surveys permit its rapid and positive identification on the ground, then our next most urgent need is for information about each tract of land--its soil, vegetation, slope, erosion, highest usefulness, etc. Some such information is available, but not enough--particularly, not over large areas for all tracts of public land, on a comparable basis. It is impossible to state how much land should be disposed of and how much retained, in the absence of such information. Management, conservation, development, and rehabilitation programs for these lands need such information. In the longrun, it would be cheaper to get it by one comprehensive examination for all land, than by the present partial and limited efforts.

A modern legal structure

for the public lands is badly needed. A confusing welter of laws has arisen in 150 years. Many specific Acts, applicable to limited areas or particular situations, and often undesirably detailed, have been passed, and few repealed. The result is confusion to the would-be land user and to the administrator alike. A simpler, fully comprehensive legal structure would make it easier to obtain the use of the public lands or their resources, and easier and cheaper to administer such lands.

Adequate appropriations

are needed, if the public lands are to make their maximum contribution to Western and National economy. A new approach should be taken to appropriations for administration of natural resources. Instead of focusing on costs, attention should be centered on results. What are these lands producing, and can they produce more economically? This involves physical production from the land, its usefulness to the local or regional economy, the price charged for it, the use made of the receipts so obtained, and the efficiency with which the administration is carried on. On all these counts, the public lands can and should do better in the future than they have in the past.

Value of Selected Metals and Petroleum in 11 Western States
1870 - 1950

(In Millions of Dollars)

Year	Gold	Silver	Lead and Zinc	Copper	Petroleum (Value at Well)	Total
1870	36.3	2.4	.5	.2		39.4
1871	34.1	5.0	1.0	.8		40.9
1872	26.7	7.7	2.0	1.1		37.5
1873	24.3	7.5	2.4	1.2		35.4
1874	24.7	8.7	2.9	1.1		37.4
1875	24.9	7.7	2.8	1.3		36.7
1876	24.5	9.9	3.6	1.3		39.3
1877	45.3	35.0	5.6	1.4		87.3
1878	49.5	37.8	4.7	1.5		93.5
1879	37.5	32.7	5.4	1.1		76.7
1880	35.7	37.0	7.2	1.2		81.1
1881	31.1	37.5	8.2	3.0		79.8
1882	28.8	39.6	10.2	6.5		85.1
1883	35.7	37.2	10.6	9.7		93.2
1884	26.6	40.2	8.4	13.0		88.2
1885	27.1	41.9	7.7	12.0		88.7
1886	30.8	38.5	10.7	9.8		89.8
1887	30.3	40.6	11.1	15.2		97.2
1888	28.2	41.2	11.4	24.0		104.8
1889	26.1	47.9	10.2	19.2		103.4
1890	27.2	55.2	11.7	25.0		119.1
1891	27.0	55.6	13.8	21.4		117.8
1892	27.3	49.2	11.7	24.9		113.1
1893	29.9	45.5	10.3	22.8		108.5
1894	35.3	30.9	8.4	22.4		97.0
1895	42.2	36.8	8.4	26.5		113.9
1896	48.0	38.9	8.6	33.4		128.9
1897	51.8	33.4	11.5	39.6		136.3
1898	56.8	32.9	13.1	42.2		145.0
1899	59.6	33.8	15.5	65.3		174.2
1900	65.0	35.6	20.9	72.5	4.2	198.2
1901	65.3	33.0	19.9	66.9	5.5	190.6
1902	64.5	30.0	17.5	55.2	5.4	172.6
1903	55.8	29.1	22.9	65.0	7.9	180.7
1904	63.7	30.9	24.6	71.3	8.9	199.4
1905	65.4	33.9	29.8	96.7	8.6	234.4
1906	67.8	38.0	36.1	124.3	9.9	276.1
1907	63.2	34.4	30.2	115.4	15.0	258.2
1908	64.7	26.4	17.7	88.9	23.8	221.5
1909	71.9	29.2	25.0	106.2	31.1	263.4
1910	73.2	30.5	28.1	104.6	36.1	272.5
1911	72.4	31.5	33.3	102.0	39.1	278.3
1912	67.2	39.5	40.2	157.3	40.6	344.8
1913	65.9	42.1	43.9	159.2	47.1	358.2
1914	68.2	37.6	40.6	122.2	50.0	318.6
1915	73.9	35.5	89.8	189.2	39.0	427.4

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Value of Selected Metals and Petroleum in 11 Western States
(Continued)

Year	Gold	Silver	Lead & Zinc	Copper	Petroleum (Value at Well)	Total
1916	66.6	49.7	129.4	380.3	59.6	685.6
1917	58.6	55.9	115.2	406.7	97.5	733.9
1918	50.6	65.8	81.9	383.8	137.2	719.3
1919	42.8	56.0	39.8	177.2	162.6	478.4
1920	36.2	59.2	65.2	180.0	229.7	570.3
1921	33.7	44.4	16.8	41.6	229.2	365.7
1922	33.5	59.1	32.3	101.1	211.5	437.5
1923	37.4	55.9	58.8	179.9	295.8	627.8
1924	38.2	41.7	66.2	176.0	327.6	649.7
1925	35.4	45.1	87.2	198.3	392.1	758.1
1926	33.5	38.1	91.7	201.3	415.1	779.7
1927	30.9	32.6	77.7	180.5	302.7	624.4
1928	30.8	32.6	70.0	222.3	267.8	623.5
1929	28.1	31.4	78.6	300.0	357.9	796.0
1930	27.3	17.9	49.7	149.1	310.1	554.1
1931	27.4	8.5	25.0	80.4	157.1	298.4
1932	28.3	6.2	13.2	25.4	166.6	239.7
1933	33.3	7.9	21.2	20.5	159.1	242.0
1934	61.1	20.3	23.5	32.9	189.5	327.3
1935	76.8	33.7	29.4	54.9	205.9	400.7
1936	92.4	45.6	37.7	86.6	261.9	524.2
1937	101.3	53.4	54.9	185.0	306.7	701.3
1938	104.4	38.1	32.4	95.2	315.2	585.3
1939	117.4	42.1	37.3	140.0	285.2	622.0
1940	122.9	48.6	54.7	185.1	277.9	689.2
1941	120.1	46.3	69.9	211.5	312.7	760.5
1942	84.9	37.5	91.7	246.5	327.7	788.3
1943	41.2	29.2	104.2	267.3	383.0	824.9
1944	32.7	24.3	108.0	246.1	418.0	829.1
1945	28.9	20.4	99.2	196.1	438.1	782.7
1946	36.2	18.2	102.6	185.4	504.4	846.8
1947	49.6	31.9	147.3	339.6	767.3	1,335.7
1948	48.3	34.1	187.4	342.9	1,138.7	1,751.4
1949	45.2	31.0	165.3	282.0	1,060.8	1,584.3
1950	53.5	38.0	173.7	360.3	1,038.3	1,663.8
Total	3,990.9	2,806.1	3,399.2	9,006.8	12,882.7	32,085.7

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PUBLIC LANDS AND WESTERN PROSPERITY

by Marion Clawson, Director,
Bureau of Land Management

A paper prepared for the annual meeting of the
Western States Council, Reno, Nevada, October 16, 1950

Twenty-four percent of the entire area of the United States is federally owned. For the 11 western States, the comparable figure is 50%. These are facts familiar to all of you, but perhaps it is well to start off by recalling them. According to the best statistics available, the area of federal land today is greater than it was 20 years ago, by some 21 million acres. In my judgment, the point of the lowest acreage of federal land in our entire history as a nation has been passed; I believe that in the future we will see more, not less, federally owned land, both for the nation as a whole and for the West as a region. The increase will probably not be large, but I believe there will be an increase. I say this in spite of the fact that there will be some disposal of land now federally owned, to private and State ownership. The chief federal agency that will do any significant disposing is our own agency, the Bureau of Land Management. We know that the operation of the land laws will take out of federal hands some of the land we now administer; in fact, we hope to take the initiative in getting rid of possibly 3 to 5 millions of acres which are in such small and scattered pieces that their economical administration is impossible. But any disposals we may make will, I believe, be far more than offset by purchases of other federal agencies, for a wide variety of purposes.

A large area of federal lands is not incompatible with our free enterprise system, nor is it in the least un-American. The federal government has always been, since its first creation, the largest landowner in the nation. Its estate was once - in 1850, roughly - about three times as large as it is today. While we have been developing our own distinctive economy and society, widely characterized as the citadel of the free enterprise system, we have had extensive public ownership of land. There is nothing contradictory in these facts. The essential explanation is that the public lands have always been used by private individuals. There has never been any extensive government operation or final use of the federally owned lands, and I doubt if there ever will be. The forage is grazed by privately owned livestock, the timber is cut by private operators, and the sightseeing is carried out by individuals arranging their own programs as they see fit.

The federally owned lands in the West are administered by several federal agencies. Our Bureau, the Bureau of Land Management, administers a larger acreage than any other Bureau - 180 million acres; the Forest Service is next, with 137 million acres; and other agencies such as the Bureau of Indian Affairs, the National Park Service, the Fish and Wildlife Service, the Soil Conservation Service, and the various military agencies administer in total perhaps 90 million acres more. Sometimes the term "public land" or "public domain" is used to apply to all of them, and sometimes only to the land our agency administers. In the discussion which follows, I am mostly referring to all federal lands in the West, unless it is clear from what I am saying that it applies to only some lands. As a good bureaucrat, I presume I should confine my remarks strictly to the lands our agency administers. But out on the ground it is sometimes hard to locate the purely man-made boundary between the various types of land, and I think you are interested in the broad problem, not merely in a particular bureaucratic share of it.

Federal Lands in the Western Economy

Federally owned lands are a vital part of the entire western economy. Take the grazing field, the range livestock industry, alone: In the Bureau of Land Management, we provide grazing for 8½ million livestock of all kinds, for an average 4 month season; the Forest Service provides for 4¼ million livestock of all kinds for an average 4 month season. Between us, recognizing that some livestock graze on both types of federal land, possibly 46% of all western range livestock find their feed for part of the year, and possibly 24% of all feed required by sheep and 12% of the feed required for cattle, come from federal lands. These figures may not seem large to you, but the federal lands are almost invariably used in combination with privately owned lands, and the number of livestock on the federal land often governs the number on the privately owned land. Built upon the range livestock production is a tremendous transportation, processing, distribution, and service activity that affects nearly every town and city in the West, and many towns and cities further east. The federally owned grazing lands are part of the foundation of all this economic activity.

From the federally owned and managed forests of the West in 1949 came 4 billion board feet of timber, or 22% of the entire cut of the West that year. Again, these figures may not seem large to you. But in many communities, a major share of the total timber cut comes from federal lands. Moreover, with few exceptions, these federal lands are being cut in such a way that their productive capacity is being permanently maintained - the sustained yield operation of which we hear so much. This volume of cut from federal lands meant roughly 85,000 men employed year round in the woods and

in primary manufacture alone; further manufacture meant more employment. And of course to this must be added employment in transportation, in service industry, in retail and other trade, and in other associated activities.

It is in recreation that the federal lands make their greatest and most spectacular showing. For the National Parks, National Monuments, and National Forests in the 11 western States, there were in 1949 a total of 63 million visits. If one person visited two areas, he was counted twice; and if he visited five areas, he was counted five times. Of course, many of these visitors were local people, out for a picnic or other simple, local use of the federal land. But with all due discounting of such use, it seems probable that several million visitors from outside of the local area visited one or more of these major types of federal land. There is no record of the number of visitors to grazing districts and other types of federal land; we know they are many, but no one can make even an intelligent guess. These visitors spend some money, of course, which provides employment and income to many people in the West. I have no desire to minimize the purely economic aspects of the recreational use of public lands, and I know that you gentlemen are better informed about what it means to the West than I am. But I hope that, in thinking of its economic importance, we do not overlook its inspirational and spiritual values, for I think these are of far greater importance. There is no measure that I know of, to contrast the relative importance of federal and other lands in the total recreation picture of the West, and perhaps no need of so doing. I think we can be sure that a very large part of the total recreational use of land in the West is federal land, and that the latter is one of the chief drawing cards to western visitors.

A large part of the total big game animals of the West graze during at least part of the year on federal land. The actual harvest of the annual increase of these game animals is regulated by State authorities, and there must be, and is, the closest working relationship between State and federal agencies. The possibility of seeing game animals, or of hunting them in the proper season, draws many people to the West and accounts for much travel and other activity within the region.

The federal lands are the source of much mineral wealth in the West, both the metals and petroleum. Many other uses of the public lands, and many other ways in which they are useful to the people of the West, could be cited, but I will not take the time to list them.

There is one way in which the federal lands involve the well-being of every person in the West; they are the major watershed

lands. In the West, water is life, and the amount of water often measures the amount of life there can be. Everyone in the West is acutely aware of the importance of water in the West, and there is general realization of the importance of healthy watersheds. The higher mountainous areas of the West generally produce most of the stream flow. As little as 20% of the total land area of a State may produce as much as 80% of the stream flow. A large part of these higher mountain areas is in National Forests, and the Forest Service is wisely concerned with their proper management. A maximum flow of clear, silt-free water, seasonably distributed so as to be of maximum usefulness, is the obvious goal of watershed management. In addition, the permanence of the watershed, as watershed, must be safeguarded. In most of the West, the lower mountain and foothill areas produce relatively little runoff but often produce a major part of the total silt reaching streams and reservoirs. These lower lands were naturally less heavily covered with vegetation and naturally have less annual precipitation, than the higher areas. Undoubtedly they were eroding rapidly when white man first saw them. Many years of uncontrolled grazing use, prior to the passage of the Taylor Grazing Act in 1934, seriously depleted the naturally scant vegetative cover. These ranges have made a great recovery in the past 15 years, but in many instances they are still subject to heavy erosion, and a positive program of erosion control is necessary. As it is, silt is reaching many reservoirs in quantities which threaten to impair seriously the value of these reservoirs at some future date.

Administration of Federal Lands

The public lands of the West are administered, for these various purposes, under a great many land laws. Many of these laws were passed several decades ago, under conditions considerably different than we now face. In fact, one of the major problems which every federal agency faces is a mass of outmoded land laws.

The federal lands and the federal agencies that administer them are some of the most important and most valuable basic assets which the West possesses. Few people will consider a federal agency an asset to a region; they are more likely to describe it in unflattering terms as unnecessary bureaucracy. But I believe that I can show you wherein the federal agencies, as well as the federal land, are important assets. I have already indicated some of the ways in which the federal land is vital to the western economy. But there are other aspects of the situation to which I wish to call your attention.

The federal lands produce significant amounts of revenue to the federal Treasury, in which the States and other governments share. Take the case of our Bureau, for instance. For the 4 years since the Bureau of Land Management was first created by the merger

of the old General Land Office and the Grazing Service, we have collected over $127 million. In this same period, our total available funds were about $27 million. Thus, for this four-year period we returned almost 5 times as much money as was appropriated to us. This was done in spite of the fact that a great many of our services are free, or performed at cost, with no thought of making a profit. We carried on a great deal of outstanding and even spectacular conservation work, the benefits of which will be most apparent in the future. Of the amount we collected, $46 millions have been paid back to the States from which the revenue arose, $55 millions have gone into the Reclamation fund, for expenditure in the West, and most of the remainder has stayed in the federal Treasury.

The situation for many of the other federal agencies is somewhat similar, though none of them are in a position to make as good a relative showing as we are. The Forest Service has collected $27½ million annually in the past four years, compared with an annual expenditure of $38 million for operation, protection, and maintenance of national forests. Additional amounts were spent by it for capital investments on the national forests and for other purposes. A large part of this income goes to aid schools, roads, and other local activities. The other federal land administering agencies have collected lesser amounts, which, however, add to an impressive total.

More important than these payments to either federal or State treasuries, of course, is the business which the activities of the federal agencies permit or encourage. The timber sold from federal land may bring in a few million to the federal treasury, but it adds several times as much to the business income of the area and State where it is cut. Likewise, the amount of grazing fees collected is only a small part of the total value of range livestock production.

Appropriation for Federal Agencies

The federal agencies need adequate appropriations, if they are to make their proper contribution to the prosperity of the West, and to get such appropriations, they need the understanding and support of the people of the West. There is a serious regional problem involved with most of the federal land management agencies. Take the Bureau of Land Management, for example. Nearly all of our work is carried on in the West, for that is where the lands we administer are located. And, by the same token, that is where the good we do is most apparent. We have excellent public relations in the West generally. But the budget for our appropriations is often handled, in Congress and before it reaches there, by men who have only limited knowledge of the West, and sometimes I fear only limited sympathy for the West. We are constantly bucking a restrictive attitude, as

far as our program is concerned. I do not blame the men involved. They often do not realize what the federal lands mean to private individuals in the West, and how essential it is that our work be properly carried on. Any reduction in our appropriation looks like a saving to them; the ill effects of insufficient funds for a federal agency occur somewhere else and to someone else.

I realize that a federal official talking about the budget of his own agency may sound like special pleading to you. I have found that many people are willing to give general support to an agency which they think is doing a good job, and give it public praise, but that they balk at active support for its appropriation. Somehow, in some quarters, it seems immoral to support publicly any federal agency in its quest for adequate appropriations. I know that organizations such as yours, and the Chambers of Commerce with which you are connected, often hesitate to ask for appropriations for a specific agency, because you oppose increased federal activities and appropriations generally. But for a few minutes let me call a spade a spade.

I am convinced that the Bureau of Land Management could take in considerably more money for the federal treasury, pay more money to the western States, and encourage considerably more private business in the West, if it but had larger appropriations. You are all aware of the fact that in private business you must spend money in order to make money. The same thing is equally true of the public lands. We sold $562,000 worth of timber off the public domain lands in the western States, outside of the O & C area, in fiscal 1949, with an appropriation of $133,000, or a ratio of 4 to 1. If we had had twice as large an appropriation, we could have sold more than twice as much timber. Right now, we have applications on hand for more timber sales than we can get to in the next two years, even if we get no more new applications, and we know that more people would apply if they thought they could get the sales promptly. The timber is there, ready and ripe for cutting. This situation exists in every western State, but is more important in some than in others. You all know how badly lumber of all kinds is needed today.

In the past three years or so, we have had a great many applications filed for oil and gas leases in Utah, because of the oil discoveries made in that period. The volume of applications has been so great as to literally swamp our Salt Lake City office. The rentals of these leases are not due until the leases actually issue. We calculate that we have been losing $150,000 monthly in Utah alone because of our insufficient staff to handle this work. An expenditure of $5,000 monthly would have brought in $150,000. Federal budget procedures are too rigid to permit us to spend more money than is appropriated or to divert funds from one purpose to another. I might remind you that under the Mineral Leasing Act, Utah would

have gotten 37½% of that revenue. What kind of business is it, to be unable to spend $5,000 to make $150,000? Have any of you gentlemen ever commented on the lack of business methods in the federal agencies? Just how would you meet this situation, if you were me?

I would be the first to agree that the loss of revenue to the federal treasury is not the most serious aspect of this situation. The really serious matter is that private business, particularly in the West, is handicapped. The timber that we can't sell does not meet payrolls, nor does it build houses. The oil and gas lease we can't issue does not permit the drilling of land for oil production. The harm is not confined to the first and direct economic activity that would follow. The timber that can't be sold can't be transported, can't provide construction work, can't provide housing for a worker in a new industry, can't buy groceries - I could add a long list of "can'ts", but I think the point is obvious.

The amount of our appropriation necessary to do these things may have been "saved" to the treasury, from one point of view; but the people of the West, in particular, suffered the loss - not once, but manyfold.

I could multiply these illustrations many times for my own agency, and I am sure that they apply with equal accuracy to other federal agencies. If the roads in National Parks are so poor, or in such bad repair, that tourists dislike to travel them, tourist travel will be less than it otherwise would be, and western income all along the line will be less. And so on. I do not mean to argue for unlimited appropriations for federal agencies. I am one of the first to call for efficiency in federal agency operations. If time permitted, I could tell you of some of the things we have done in the Bureau of Land Management in recent years. In one important part of our work, we have stepped up the output per worker over three-fold in less than three years. I believe more can be done in our agency, and we are striving to do it. No doubt every federal agency can make some improvements. Nor am I unaware that these are unsettled times, internationally speaking, and that there is great need to keep federal expenditures to the minimum. But such arguments are beside the point. The kind of expenditures I am talking about add to national strength; they help, in their small way, to balance federal budgets. We do not grow strong by letting lie unused timber that is ripe for harvest, by letting go undone those things on which productive private business is dependent.

Contrast of Water and Land Programs

Some serious "imbalances", or discrepancies, have grown up in our federal appropriations, in recent years. The expenditures

for water and power development have grown greatly, while the appropriations for land managing agencies have about held their own, if allowance is made for the much higher costs of operation today. During the 1920's, the Bureau of Reclamation spent roughly $9 million annually and the Corps of Engineers spent roughly $62 million annually; TVA, Bonneville Power Administration, and the others were unheard of. For the fiscal year ending June 30, 1949 all these water and power agencies spent more than $1 billion, or 14 times as much as was spent for these same functions 25 years ago. Irrigation, both private and public, has helped to build the West in the past, and federal irrigation will add greatly to western productive capacity in the years ahead. Hydroelectric power has been, and will continue to be, a factor in western industrial growth. I am all for such development, and I concede that the money so spent is largely returned to the federal treasury. I cannot help but point out that such reimbursement as does occur takes from 40 years upward to occur, whereas the land projects I have just described pay back their cost, 2 or 3 or more times over, in the same year.

While this was going on, what was happening to the land managing agencies? In the 1920's, the Forest Service, the Bureau of Indian Affairs, the Fish and Wildlife Service, the General Land Office, and the Park Service combined had an annual expenditure of roughly $107 million. In fiscal 1949, they had $204 million or twice as much. Even if allowance be made for the Soil Conservation Service, which is new since 1930, the picture is still far different than for the water management agencies. The expansion of the water agencies has been 7 times that of the land agencies.

The plain fact is that we have built our dams faster than we have managed our watersheds or sold our timber, and faster than we have improved spawning grounds to offset the fish lost because of the dams. Our water and our land programs are not in balance. The water programs have forged ahead faster than the land programs. No one wants to hold back the water programs, but many of us do want to speed up the land programs to a more nearly equal pace. I should point out further that the increased population of the West in the past 20 years has greatly increased the demand for public land. There are several factors responsible for this step-up in water programs. In my judgment, one of the most important was the emphasis upon large scale public works during the Great Depression. We seem never to have fully overcome our PWA complex; we wanted to build something big and concrete (no pun intended!). We must admit that a big dam is something greatly to be admired, and that appropriations for it are something that almost everyone will support vigorously. Comparatively, much of the land management work is less exciting and less tangible, although, as I have pointed out, from an immediate business point of view it may be much more feasible and practical.

Contrast of Land Agencies

Imbalances in programs also exist among land management agencies. We should be equally frank in looking at the appropriations made to different agencies, even though we may run the risk of stepping on someone's toes in so doing. I do not mean to criticize anyone, but I think a full look at all the facts is necessary. Let me contrast the situation between the Forest Service and the Bureau of Land Management. The Forest Service is recognized the world-around for the job it has done and is doing in the management of the national forests. Compared with the Bureau of Land Management, the Forest Service has a slightly smaller area of land to administer, collects somewhat less revenues, and has over ten times the appropriation. Naturally, the comparison is not as simple as this one sentence might sound. Each agency carries on some functions not carried on by the other; we spend nearly half of our budget for jobs which the Forest Service does not do, and it spends a lot of its money for things that we do not do, such as research. The characteristics of the land are different, too. But when this overall comparison is broken down by areas, or by functions, there is still a great discrepancy. The Forest Service has more full-time employees here in Nevada, for instance, than we have, although we administer several times the area of land. In timber management, or in range management, the Forest Service has available to expend, and does expend, several times as much money per unit of area as we do. Similar comparisons may be made of Bureau of Land Management and Forest Service districts in the forested areas of Western Oregon where the staffing by the Forest Service is more than 5 to 1.

I cite these comparisons more in envy than in criticism. Would that we had the money to carry out a similar management program which is so badly needed on the public domain lands. Seriously, the level of administration which we are able to give the lands under our jurisdiction is much lower than we think proper, or than we think is profitable to the United States. We believe the western States have a right to be dissatisfied with the program we are able to carry out. We believe they should consider the dollars and cents and business aspects of the situation and insist on more adequate management by our agency.

Conclusion

In closing, I would like to make two major points on which help is needed in the administration of the public lands of the West - help which you may be able to give:

1. There needs to be a much wider public understanding of the contributions of public land to the prosperity

of the West, and of the ways in which that public land can aid western prosperity.

2. The federal agencies administering those lands must have adequate appropriations, if they are to meet their full responsibilities and are to aid, not impede, western development and prosperity.

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ADDRESS BY DIRECTOR MARION CLAWSON OF THE BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR, FOR THE TWENTY-FIFTH ANNUAL MEETING, WESTERN FARM ECONOMICS ASSOCIATION, AT FLAGSTAFF, ARIZONA, JULY 23, 1952

For Release At 2:00 P.M., JULY 23, 1952

THE ROLE OF THE PUBLIC DOMAIN IN THE ECONOMY OF THE WEST

Mr. President, Mr. Chairman and Members of the Association:

Public lands have been, are, and will continue to be important in the economy of the West.

With minor exceptions, the entire area of the 11 Western States was once Federal land. The laws and terms under which this land passed into private ownership for agricultural, mining, forestry, and other uses have in large measure influenced the character of such use. The circumstances under which the Federal Government reserved large areas of land from disposition to private owners and the manner in which these lands are administered and managed largely determine present day uses of such land and thus considerably affect the present day western economy. Until recent years the process of land disposal was a selective one, with the individual citizen or his corporation determining which lands should go to private ownership. In spite of this selective process, the remaining Federal lands in the West are valuable, produce considerable revenue, and are in active, and increasing demand.

Present Land Ownership in the 11 Western States

Of the 676 million acres in the 11 Western States, 60% is owned by the Federal Government. Of this, roughly three-fourths is administered by the Bureau of Land Management and by the Forest Service.

Land Ownership and Administration, 11 Western States

Ownership and administration	Million acres	% of Total
Federal lands administered by		
Bureau of Land Management	179	26
Forest Service	137	20
Bureau of Indian Affairs 1/	45	7
National Park Service	14	2
Other agencies	32	5
State-owned lands	47	7
Privately owned lands: cropland	51	8
other 2/	171	25
Total	676	100

1/ Strictly speaking, these are not Federal lands, but belong to the Indians. The Federal Government acts as guardian for them, and they are generally regarded as Federal lands for this reason.

2/ This is largely a catchall category and hence includes any errors or discrepancies in the other figures.

Growth Dominates the Western Economy

Growth is the dominating characteristic of the western economy. The population of the 11 western States has increased from 17 to 78% each decade since 1870, with an average increase of 47% per decade. Per capital income and output has certainly increased greatly during those decades also, although precise data are lacking. In many lines of economic endeavor, growth in the West has been far greater than for population. Expansion of economic output has meant heavier demands upon natural resources of all kinds--croplands, grazing lands, forests, minerals, and others.

The increased demand for natural resources falls today with particular force on the public lands. Resources not in demand at some earlier period, perhaps because inaccessible, low grade, or expensive to develop, now are useful and valuable. This is true for virtually every type of natural resource. Reconciliation of increased demands, one against another, and of the total against the capacity of the resources themselves, constitutes a major problem for the Federal land administrator.

Grazing on the Public Lands

Grazing uses more land surface than any other land use in the United States, and this particularly is true in the West. Grazing is an important use of Federal lands in the West, not only in terms of quantities of feed produced but also because of the seasonal integration of private and public lands of different physical characteristics into single economic operating units. Approximately 20,000 livestock operators use grazing district forage, 25,000 use national forests, and 15,000 others use other types of Federal lands. There is an unknown degree of overlap among these numbers, but perhaps as many as 45,000 operators use some type of Federal land. This compares with 67,000 ranches, as shown by the 1930 Census. These data are not precisely comparable, but are the best that exist, and give an approximate idea. About 55% of the range livestock of the West graze some part of the year on Federal land, and find 23% of their total feed requirement there.

Numbers of livestock grazed on national forests today are less than half of peak numbers in 1918, and a shortening of the grazing season has further reduced the number of animal unit months grazing until they are one third or less of the

peak. Since grazing districts were fully organized, there has been a slight downward trend in livestock numbers grazed. The Bureau of Land Management estimates that carrying capacity of the grazing districts can be increased 30% by a major long-term improvement program, including reseeding, water spreading, and other features. At present livestock prices, much of this is economically sound in terms of increased forage alone, and in addition substantial downstream benefits, in terms of reduced sedimentation, are achieved. The increased forage is in heavy demand.

Forests on Public Lands

Area, volume of commercial timber, and current cut, forests in the West

Ownership and agency	Area		Volume		Cut (1951)	
	Million acres	%	Billion board feet	%	Million board feet	%
Federal forest service	53	48.1	520	48.0	3,774	18.1
B.L.M.	6	5.5	79	7.3	520	2.5
Other 1/	7	6.4	34	3.2	700	3.4
Private, State, Co., etc.	44	40.0	450	41.5	15,775	76.0
Total	110	100	1,083	100	20,769	100

1/ Including Indian reservations. See footnote 1, previous table.

A few significant facts characterize Federal forests in the West: (1) the acreage of federally owned forests is 60% of the total forested acreage; (2) Federal forests contain approximately the same percentage of commercial timber than they do of acreage; (3) Federal forests contribute less than half as much in in proportion to the annual cut of timber than their proportionate share of the volume; and (4) cutting on Federal forests is in general well below--often at only

half--sustained yield capacity, whereas cutting on private forests has in general been well above--often double--sustained yield capacity.

Minerals from Public Lands

Roughly half of all mineral production in the United States is from the 29 States originally created out of the public domain, and about one-third of the national total is from the 11 Western States. The proportion from the West is higher for the metals. All this came from land once federally owned, though most of it is now privately owned. The Federal Government in fiscal 1951 collected over $37,000,000 in rentals and royalties under the Mineral Leasing Act. The trend in applications for public lands under this Act has been sharply upward in the past decade. Public lands contribute 96% of annual potash production, 5% of oil and gas, and 1% of phosphate.

Many students of the mineral situation believe that the greatest potentiality for future increases in mineral production lies on the public lands. Our expanding industrial economy requires large volumes of minerals, and present sources in some instances cannot meet the increased demands.

Recreation on Public Lands

In 1951, there were about 95 million visits to national forests and about 35 million visits to national parks and monuments, plus unknown but many million visits to other public lands, and also to federally constituted water development projects. These are national totals but a substantial part occurred in the West. These are visits, but certainly many million persons enjoyed Federal lands and waters in the West. The trend has been sharply upward, with 1951 at roughly double the prewar peaks. There is every reason to expect a continuation of this upward

[illegible]-[illegible] [illegible] capacity, [illegible] [illegible] [illegible] has in general [illegible] [illegible] [illegible] [illegible] [illegible].

[illegible] in [illegible] [illegible]

[illegible] end of all [illegible] [illegible] [illegible] [illegible]

trend. Such greatly increased recreational use of the public lands not only strains to the utmost facilities and areas devoted to such use, but entails a major problem of reconciling this use with other uses.

Water from Public Lands

In much of the West, the high mountain ranges, often in national forests, contribute most of the runoff and but little sediment to streams, while the lower ranges, often in grazing districts, produce but little runoff but proportionately more of the sediment. The area contributing 80% of the runoff may yield but 20% of the sediment, and, conversely, the area with 20% of the runoff may yield 80% of the silt. Watershed management, to increase consciously the volume and improve the quality of runoff, is in its infancy. Protection from fire and erosion is generally accepted as necessary or desirable. But forest management involves more than fire protection; so does watershed management. Some believe that water yield may be increased 25% to 50% without damage to the watershed. Control of type and density of vegetation now seems the most likely method of achieving this goal.

On several watersheds, definite programs are under way on public lands to reduce erosion and silt movement, by structures and vegetative treatment. There are major problems of coordination of programs on public lands with those on private lands. The soil conservation districts may provide the most effective mechanism. There is also a problem of the downstream water user who thinks his interest is best served by a maximum volume of water from the upper watershed, regardless of its quality.

At least two possibilities of revolutionary technique are on the horizon, in the water utilization field: (1) artificially induced precipitation, and (2) refinement of sea water. New techniques in energy development, especially

use of oil shale to produce petroleum and use of low-grade coal for generation of electricity, may bring vastly increased demand for water in areas where it is scarce.

The total demand for water in the West will almost surely increase greatly in the next few decades.

Multiple Use

Multiple use is use of the same area of land for two or more purposes concurrently. It offers the Federal land administrator his greatest opportunity and his biggest headaches. It should be obvious, from this paper, that all demands for Federal land are increasing, and that their reconciliation will be a major undertaking.

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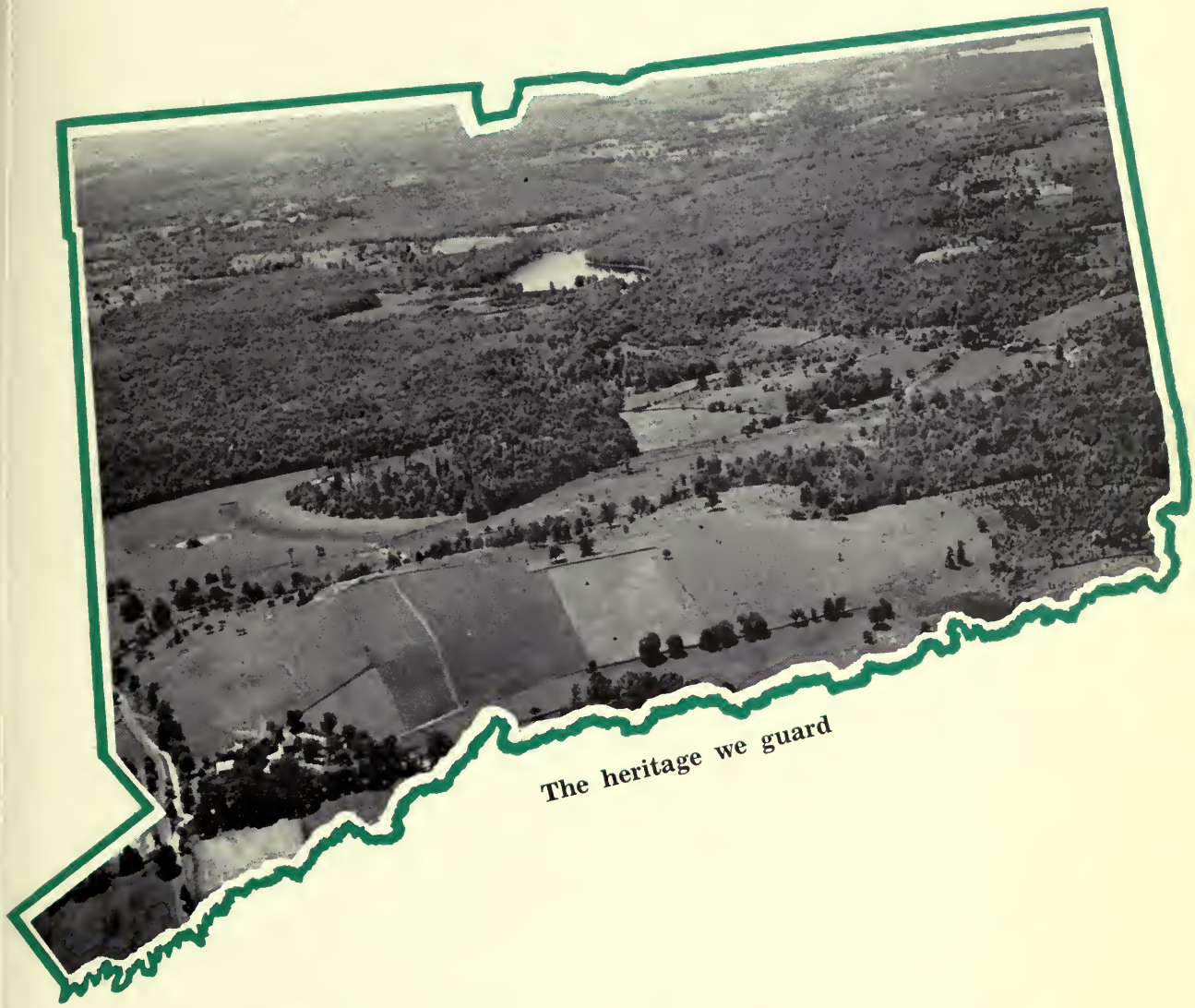
Connecticut's Natural Resources

Conserved – They Serve



A publication of the

Agricultural Extension Service

UNIVERSITY OF CONNECTICUT, STORRS, CONNECTICUT

MP1

November 1952

Connecticut's Natural Resourc

TO THE PEOPLE OF CONNECTICUT:

For more than three centuries Connecticut's soil has produced food for people and feed for the animals on her farms, whose products, in turn, nourish her people. From her streams and lakes comes the water that is an essential of all life. Her forests provide employment and income, as well as wood products that are used in our daily living. Together, her streams, lakes and forests, with her hillsides and valleys, provide opportunities for sport, relaxation and recreation, and a habitat for the wildlife that increases our enjoyment of the great out-of-doors.

Nature was good to Connecticut when she provided the state with its natural resources. She is doing her share to continue them. But the citizens of Connecticut have a responsibility too — the responsibility of conserving and using these resources wisely so that we of today and our successors of tomorrow can benefit from them.

Many people are becoming increasingly aware of that responsibility. As individuals and through agencies and organizations we are giving more attention to the good management and wise use of our resources. That, in essence, is conservation.

Connecticut's public agencies that are interested in conservation include the College of Agriculture at the University of Connecticut, the Connecticut Agricultural Experiment Station, the Connecticut Natural Resources Council, the State Soil Conservation Service and the State Production and Marketing Administration of the United States Department of Agriculture, the Connecticut Department of Farms and Markets, the Connecticut Park and Forest Commission, the State Water Commission, the Connecticut Department of Fisheries and Game, the State Soil Conservation Committee, and others. In addition, there are many private groups whose interest is conservation.

If to the interest of those agencies and groups there is added the interest of each of us as individuals, Connecticut's natural resources will continue to be her greatest asset.

It is to that end that this brochure is devoted.

W. B. Young,
Dean and Director,
College of Agriculture.

re Her Greatest Asset . . .

Connecticut is richly endowed with natural resources of soil, forests, water and wildlife

It's **SOIL** totals 3,135,000 acres. Of that acreage there is used as farmland — 853,000 acres as follows:

9,000 acres of potatoes
26,000 acres of vegetables and small fruits
50,000 acres of corn and grain
14,000 acres of tree fruits
19,000 acres of tobacco
138,000 acres of idle and other farm land
597,000 acres of pasture and hayland which provides feed for 168,000 dairy cattle
3,500 beef cattle
7,000 sheep

as other land — approximately 375,000 acres are occupied by cities, towns, roads, etc.

It's **FORESTS** total 1,907,000 acres of which 523,000 acres are woodlands on farms 1,384,000 acres are forest of which 16,270 acres are in 56 state parks and 122,801 acres are in 26 state forests.

It's **WATER** resource includes over 1000 lakes and about 7600 miles of streams and rivers.

The soil, forests, lakes and rivers, with the wildlife they support and the recreational opportunities they provide, are Connecticut's heritage.

. . . They Are Yours to Use, Wisely

Back of the milk bottle on the city consumer's doorstep is good feed grown on well-managed soils for Connecticut's dairy cows.

SOIL

Connecticut's soil has been farmed for over 300 years. It consists of many different types, but most of it is a fine sandy loam that requires good management to keep it productive. Stoniness and the rough topography of the land in many parts of the state, the result of the glacier that covered Connecticut many centuries ago, limits its use for cultivated crops in those areas.

"When they suffer abuse they're no longer of use." Fields unprotected with grass or a cover crop lose rich topsoil through erosion.

Connecticut's crops are only as good as the soil tho produces them. A good crop of hay such as this is th result of proper soil management.

Connecticut's world-renowned tobacco crop, worth about $25,000,000 annually, is grown on soil that demands the utmost in good conservation practices.

SOIL

Connecticut's soil and climate make it possible to grow many kinds of crops, the most important being grass, corn, potatoes, tobacco, fruit, vegetables and trees. Continuous high yields depend upon proper soil and crop management through the use of crop rotation, fertilization, and such soil conserving practices as contour farming, strip cropping, etc.

On a sloping field contour planting helps to prevent erosion. On this field the water "walks" instead of runs down the slope.

After a cultivated crop is harvested, a cover crop is planted to protect the soil from wind and water erosion.

The wooded slopes on reservoirs maintain an even run-off, prevent erosion, and provide a never-failing supply of clear, sparkling water.

WATER

Everything that has life requires water. Connecticut's farms, homes and industrial plants use millions of gallons of water every day. Its source is the rivers, brooks and ponds with which the state is so plentifully supplied, and the wells that man has made. Reforestation and grassland farming help to conserve our water supply.

Behind the water supply in the rural home is an underground storage that is dependent upon good resource management.

This picture tells its own story. It was taken in Connecticut.

Water when and where it is needed is becoming increasingly important in producing Connecticut's crops.

WATER

Water must be controlled if it is to serve man's purpose. Conserved in reservoirs, ponds or wells it becomes his servant. He can make it available when needed to provide himself, his crops and livestock with one of the essentials of life itself. Uncontrolled, it can make his land unfit for use or destroy his property with a devastating flood.

Many acres of wet land are made productive by the construction of drainage ditches.

Farmers construct ponds to provide water for fire protection, for livestock and irrigation, and for recreation for the family.

The best use of steep slopes and rough land is to produce the tree crops that provide lumber, posts, ties, poles, charcoal and fuelwood.

FORESTS

Of the little more than 3,000,000 acres of land in Connecticut, nearly 2,000,000 acres are forested. Most of it is in small wooded areas on farms. These woodlands not only produce wood crops but they also protect our soil from erosion, conserve our water resources for industrial and home use, and offer opportunities for recreation.

To produce the best wood crop, the woodlot must be managed as carefully as any other farm crop.

Wood removed as thinnings provides an annual cr and improves the growth of the trees that are le

Idle land produces no income. Land such as this, unsuited for other use, often can be made productive by planting it to a crop of trees.

FORESTS

There is scarcely a farm that does not have an odd corner or other area that is too rocky, too steep, or otherwise unsuited for agricultural purposes. These areas offer an excellent opportunity to realize an income from the planting of trees either for timber or as Christmas trees. While growing, they protect soil and watershed, and provide cover for wildlife.

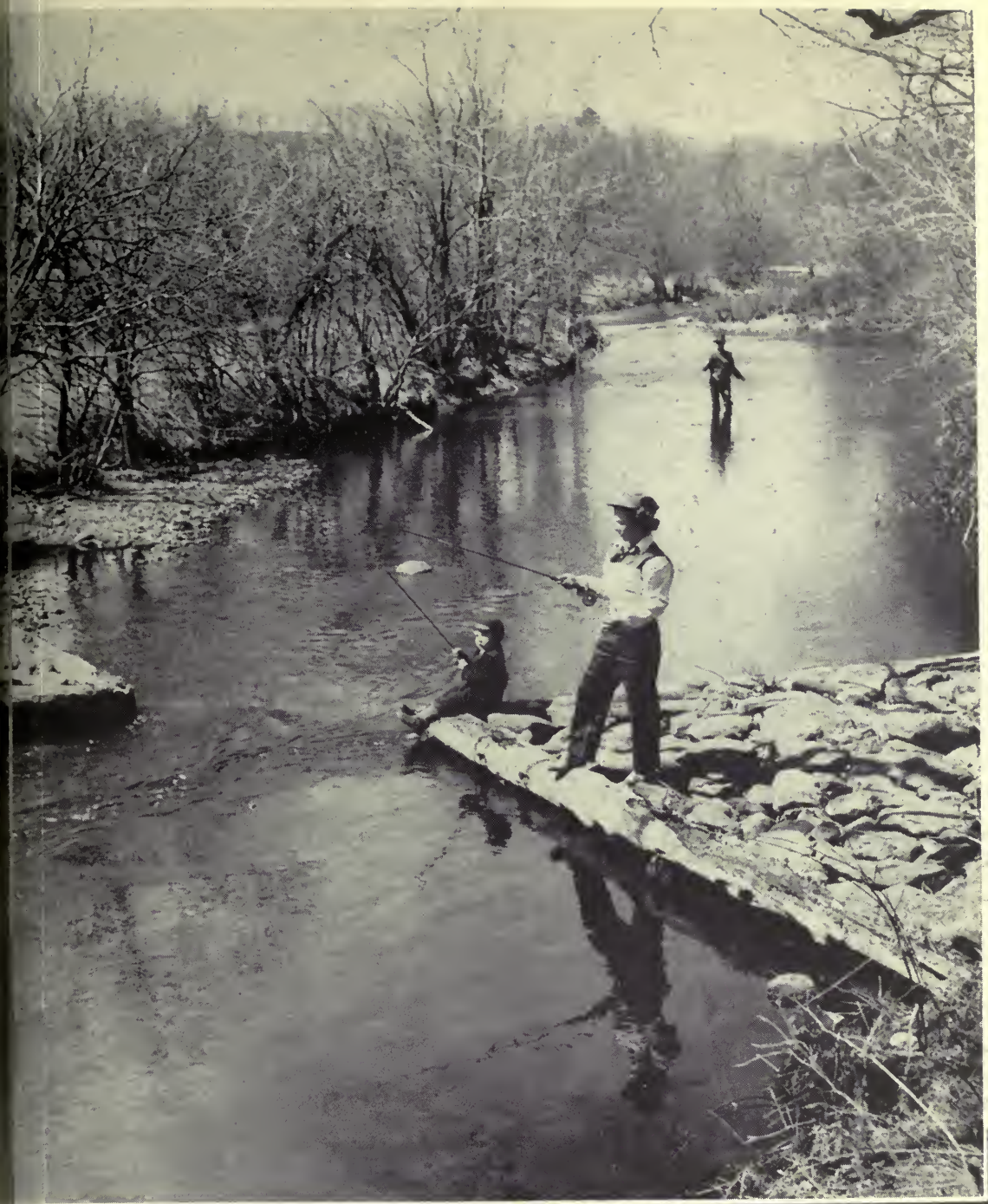
ome-grown Christmas trees are becoming an increasingly important farm crop.

Plantations provide a future source of forest products, game cover, and help prevent soil erosion.

RECREATION

With camera or gun, the wildlife living in Connecticut's woods and fields provides healthful outdoor recreation.

Many kinds of wildlife find food and shelter in the shrub borders along woodlands and fields.



RECREATION

through good management and wise use Connecticut's streams, woodlands and fields inue to provide recreation and relaxation.

uring family enjoys lunch at one of the 145 dside picnic areas maintained by the State Highway Department.

This publication was prepared by a committee consisting of Floyd M. Callward, forester, chairman; Henry M. Hansen, county agent leader; N. Paul Tedrow, state conservationist, Soil Conservation Service; and Harold W. Baldwin, editor. The committee acknowledges with appreciation the photographs provided by the following: Connecticut Development Commission, Soil Conservation Service, Russell S. Anderson, State Water Commission, Wastes Engineering Magazine, Connecticut Park and Forest Commission.

Good management and wise use is conservation

Connecticut Agricultural Extension Service, W. B. Young, Director, Storrs, Connecticut. Issued in furtherance of the Acts of Congress of May 8 and June 30, 1914.
(10,000)

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TIMBER RESOURCES
AND
THEIR AVAILABILITY
TO
A WOOD WORKING INDUSTRY
IN THE
COOK COMMUNITY

RESEARCH AND STUDY

MADE BY

THE COOK AREA PLANNING BOARD

COOK, MINNESOTA

1941

PRESENTED TO THE

MINNESOTA RESOURCES COMMISSION

AND

COMMISSIONER OF

IRON RANGE RESOURCES AND REHABILITATIONS

INTRODUCTION

This bulletin is a study of the available timber supply and the items of cost which would concern a wood-working industry which might consider locating in this community. Timber volumes given are conservative in all cases. Costs quoted are average figures taken in many cases from various timber and wood using operations in the immediate or neighboring vicinity.

The Planning Board hopes to interest a reliable industry in establishing in Cook to utilize the large volumes of mature aspen in the area. It feels that such an enterprise could prosper with the large amounts of raw material available, and at the same time, assist the community from the labor and business standpoint.

This is one of the few areas in Minnesota where large blocks of mature aspen are still available and accessable for logging.

Cook Area Planning Board

BOX FACTORY OR OTHER WOOD-WORKING INDUSTRY

I - Availability of Wood

A - Species

a - Aspen - Abundant all over the area

b - Elm and ash - Occurs mainly in swamps and rivers and streams

These two species have apparently been used for no other purpose but fire wood and occur in quite heavy stands. The wood is unusually sound and should make excellent box lumber.

c - Balm of Gilead - Occurs in abundance on the better aspen sites, and, although it is very much inferior to species mentioned above, it has properties which make it of value for some part of box construction requiring little strength.

d - Balsam -

Balsam fir occurs mixed in aspen stands in small quantities and harvested with the aspen can be sawed into box lumber, making a very suitable product.

It is a very fast growing tree and will be very important in the future.

e - Jack Pine -

In the vicinity of Cook and the farming area this species occurs in only scattered stands.

However, there are large volumes of this species in the Superior

e - Jack Pine - continued -

National Forest within a radius of 40 miles of Cook.

This wood also lends itself well to box and crating construction.

B - Quality and Properties of Main Species -

1 - Aspen - The seasoned wood of this species is grayish white in color and generally is straight grained, with a fine and uniform texture. Other properties are: a - Light in weight (26 lb. per cu. ft.) - b - Weak - c - Soft - d - moderately stiff and low in resistance to shock - e - large shrinkage - f - easily glued - g - low in nail holding quality - h - little tendency to split in nailing - i - does not impart taste or odor - j - takes stain, varnish and paint well.

2 - Jack Pine - Jack Pine is similar to other pines except that grades are usually lower due to numerous knots. Wt. per M.B.M. (12% moist) is 2400 lbs. This wood is medium workable and fairly adaptable to paint.

3 - Elm - This species occurs only in the lowlands, but grows to large size. It is a tough wood, does not split easily, is not very workable with hand tools. It weighs 2900 lbs. per M.B.M. (12% moist).

4 - Balsam - This wood has fairly good nail holding qualities, is very light wood when seasoned - 2100 lbs. per M.B.M., and is of mediumed workability. It occurs in all aspen stands as a minor species, but is conveniently logged with the aspen.

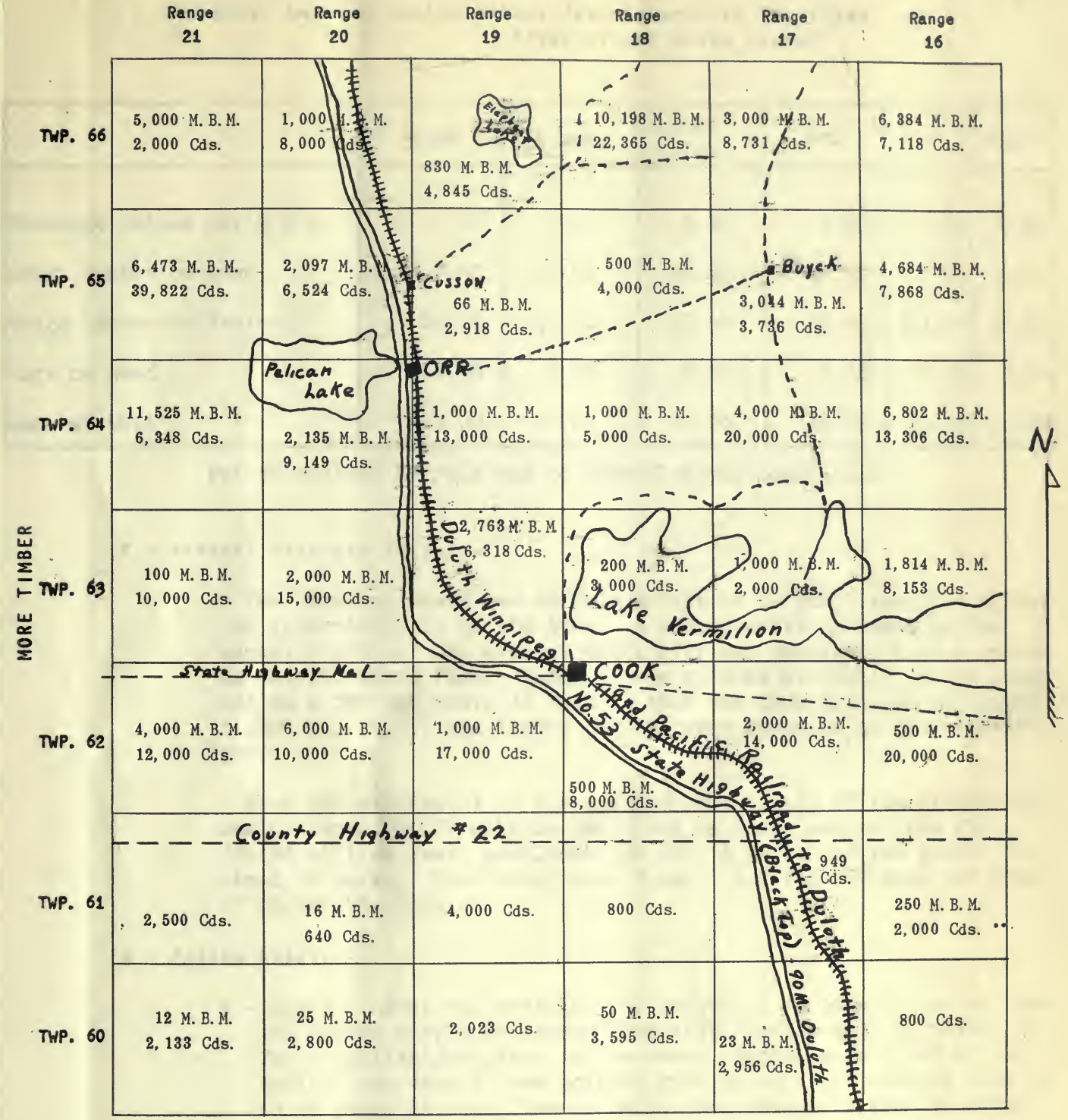
TOWNSHIP VOLUMES BY SPECIES

TWP.	RGE.	ASPEN		JACK PINE		BALSAM		BIRCH		OTHER (W & R PINE)	
N.	W.	M.B.M.	CDS.	M.B.M.	CDS.	M.B.M.	CDS.	M.B.M.	CDS.	M.B.M.	CDS.
66	16	6,384	7,118	7,611	9,194	227	2,004	332	3,212	3,256	315
	17	3,000	8,731	250	2,292	12	280				629
	18	10,198	22,365	2,036	5,506	100	1,367				2,400
66	19	830	4,845	8	471		182		1,547	5	580
66	20	1,000	8,000	200	6,000		1,000		4,532	23	3,347
66	21	5,000	2,000		3,000		750		2,585	17	2,335
65	16	4,684	7,868	7,902	15,000	150	690	132	2,412	2,520	351
	17	3,044	3,736	774	4,507	24	417				270
	18	500	4,000	100	2,000		400		1,000		
	19	66	2,918	65	1,306		438		580	2	890
	20	2,097	6,524	1,235	3,730		1,398		2,173	946	6,532
	21	6,473	39,822	397	4,031		2,777		3,161	6	2,377
64	16	6,802	13,306	8,819	16,859	1,052	1,135	209	2,950	1,752	4,239
	17	4,000	20,000	3,000	15,000		300				
	18	1,000	5,000	1,000	20,000		1,000				
64	19	1,000	13,000	140	2,806		679		967		1,900
	20	2,135	9,149	36	759		4,066		12,000	24	4,000
	21	11,525	6,348	20	90		9,000		23,154	205	2,000
63	16	1,814	8,153	490	1,997	322	2,384	267	2,308	494	1,076
	17	1,000	2,000	2,000	15,000						
	18	200	3,000	500	8,000						
63	19	2,763	6,318	561	3,516		2,116	14	2,266	75	1,000
	20	2,000	6,000								
	21	100	4,000								
62	16	500	3,000								
	17	1,000	4,000								
	18	500	2,000								
	19	1,000	4,000								
	20	2,000	5,000								
	21	2,000	6,000								
61	16	250	2,000	400	3,000						
	17		949	1,856	843		113	925	395		
	18		800	30	500	54					
	19		4,000	660	5,000		88				
	20	16	640	400	976			50	15		
	21		2,500				600				
60	16		800	30	500						
	17	23	2,956	483	1,200	28	570		320		
	18	50	3,595	221	1,991	26	1,271	24	856		
	19		2,023	600	2,181	16	312		209	500	
60	20	25	2,300	66	156	40	1,883	37	438		
60	21	12	2,133	34	125	20	690	321	529		
			800	30	500						
Total		84,997	263,397	41,924	157,536	2,071	37,910	2,311	67,609	9,825	34,241

NOTE:

M.B.M.= 1,000 Bd. ft.
(Material 8" & over in Diam. Breast High)

CDS.= Cords
(Material 5" to 8" in Diam. Breast High)



SCALE - 1" 6 MILES

LEGEND

Railroads

Blacktop Highway

Graveled Road

M.B.M. = Thousand Bd. Ft. (Material 8" and Over in Diam. Breast Ht.)

Cds. = Cords (Material 5" to 8" in Diam. Breast Ht.)

BOX FACTORY - Cont'd.

E - Stumpage, Log and Lumber Values (All ownerships (Private), (Federal and State Lands).

	Aspen	Balsam	Jack Pine	Ash	Elm	Birch
Stumpage Values per M.B.M.	$ 1.50	2.00	3.00	1.50	1.50	2.00
Rough Lumber on Road	17.50	17.50	19.50	17.50	17.50	17.50
Rough Lumber at Factory	20.50	20.50	22.50	20.50	20.50	20.50
Logs on Road	7.85	7.85	9.85	7.85	7.85	7.85
Logs at Mill	12.00	12.00	14.00	12.00	12.00	12.00

Prices subject to rise due to unsettled war conditions.

F - Present Possible Output -

The Planning Board has on file a list of 31 small sawmills operating intermittently in the area. A conservative estimate of the annual output of the average small mill has generally been accepted as 500,000 board feet. Based on the volumes available in the area, and on a 300 day year, it is felt that the Cook area can mill about 51,000 bd. ft. of box lumber per day over a period of the next seven years.

From the standpoint of a sustained output, all of the present volume of Aspen (84.99 million feet) and half the mature Jack Pine (20.96 million feet) should be cut over a period of ten years, instead of seven. This would mean a daily cut for 300 days per year of 36,000 bd. feet.

G - Future Supply -

a - Aspen - After the next 10 year period it is safe to assume that the future supply of lumber from this species will be unlimited for a utilization plant in the area. Approximately 60% of the entire Cook area is now covered with aspen types ranging from 10 to 40 years in age. Measurements show that this type of timber grows from one to two cords per acre per year, and the most conservative figure shows a total growth for the area per year of 500,000 cords.

b - Other Species - The supply of Jack Pine in the extreme eastern portion of the area will be plentiful for the next forty years due to the large acreage of Jack Pine in the 40 to 70 year age class. The younger age classes after that period are problematic. There will always be a good mixture of Balsam with the Aspen, since this species is coming in heavy after past logging operations. The White Pine and Red Pine stands are giving way to the Aspen and Balsam types and cannot be depended upon for heavy production in the future.

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II - Labor

A - Number Available In Cook - 35 men

B - Number Available Within 10 Miles of Cook
(200 available for work in Plant)

C - Education and Experience

1 - 8th grade and high school graduates. Many have been in the timber industry and are familiar with the wood working industry.

D - Nationality

1 - Finnish Americans

2 - Norwegian Americans

3 - Swedish Americans

E - Wage Rates (wage rates at plant 40 miles east of Cook)

1 - Unskilled - $.37 per hour
2 - Ripper .42 " "
3 - Nailer .40 " "
4 - Resaw man .40 " "

F.- Unemployment Insurance

1 - 7 men or less men employed - no need of unemployment insurance.
2 - Employer pays 3% of salary into unemployment insurance

G - Social Security
1 - Employee pays 1% of wage
2 - Employer pays 1% of wage

H - Compensation Insurance
1 - Depends upon the risk
2 - Rates paid applicable to box factory

III - Sites, Water, Power and Taxes for Plant Development

A - Acreage vailable

a - Price ($1,000.00 per 40 acres)
b - Location with reference to Railroad
  1 - On railroad siding
c - Availability of water
  1 - Village water supply available
  2 - Little Fork River near site

B - Power

a - Electricity rates in Cook by Arrowhead Light and Power Co.

Schedule "B":

1 - Light:

First 50 K.W.H. used per mo. $ .08
Next 50 K.W.H " " " .07
Next 1500 " " " " .05
Excess K.W.H. " " " .04
Minimum $1.25 per month, Service Charge $.60

Schedule "C" - Power Rate:

First 250 K.W.H. used per mo. $ .05
Next 1500 " " " " .04
Excess " " " " .03
Minimum $2.50 per month, but not less than $1.00 per horsepower of connected load.

All of the above rates are net. Energy will be billed at .01¢ per K.W.H. higher than the above rates and .01¢ per K.W.H. will be allowed if paid by the discount date.

b - Northern Electric Co-operative
(Line runs north of town at Village limits)
Class of service desired and size of instalation would determine rates
Rates studied and approved by the Rural Electrification Administration, Rate Section, Washington, D. C.

c - Other Fuels

1 - Gasoline
Wholesale Regular grade -$0.19.6
(4¢ rd. tax incl.)
Wholesale Low grade - 0.18.6
(4¢ rd. tax incl.)

2 - Diesel Fuel - $ 9.20 per hundred gallons

3 - Fuel Wood (Birch) $ 7.50 per 4' x 4' x 8' cord

4 - Bituminous Coal
Steam Coal - $10.00 per ton

C - Water Supply

a - Little Fork River near site
b - Well water - Village water system

D - Climate

a - Minimum temp. 40 degrees F. below zero - Maximum temp. 90 degrees F.
b - Average snowfall - 80" - precipitation - 28" mean annual temp. 38 degrees F.
c - Snow on ground 5 months of year
d - Extensive winter logging done because of use of snow and ice roads

III - Sites, etc. - Continued

E - Taxes

1 - In Cook

a - Total real estate and personal property tax rate - (1940) - 205.8 mills

2 - Townships outside of Cook total tax Rate (1940)

Owens - 182.8 mills
Field - 172.9 "
Beatty- 187.3 "
No sales tax in Minnesota

F - Insurance Rates (Fire)

1 - In Cook

a - Volunteer fire department in Cook
b - Little Fork River boarders site
c - Rates
Rates depend on hazards
Ardin Block business center $7.00 per $100.00 annually.
Residential $.42 per $100.00 annually.

2 - Outside town limits

$1.10 per $100.00 farm rates
Lumber piles in woods $7.50 per $100.00
Lumber piles 200' cleared all around - $2.00 per $100.00
Local lumber yard pays $2.00 per $100.00 annually.

A Volunteer Fire Department has been organized, and insurance rates are in process of lowering.

IV - Transportation Facilities

A - Railroad

The Duluth, Winnipeg & Pacific railroad passes through Cook with scheduled freight trains two times per day. Rates for special commodities can be obtained upon application to the Railroad and Warehouse Commission (Competitive rating)

B - Lake (Great Lakes)

The Great Lakes offer a possibility of cheaper transportation to eastern markets, through the port at Duluth, 90 miles distant.

C - Truck

Cook is serviced by black-top State highway from the south. It is well maintained and passable in all seasons.

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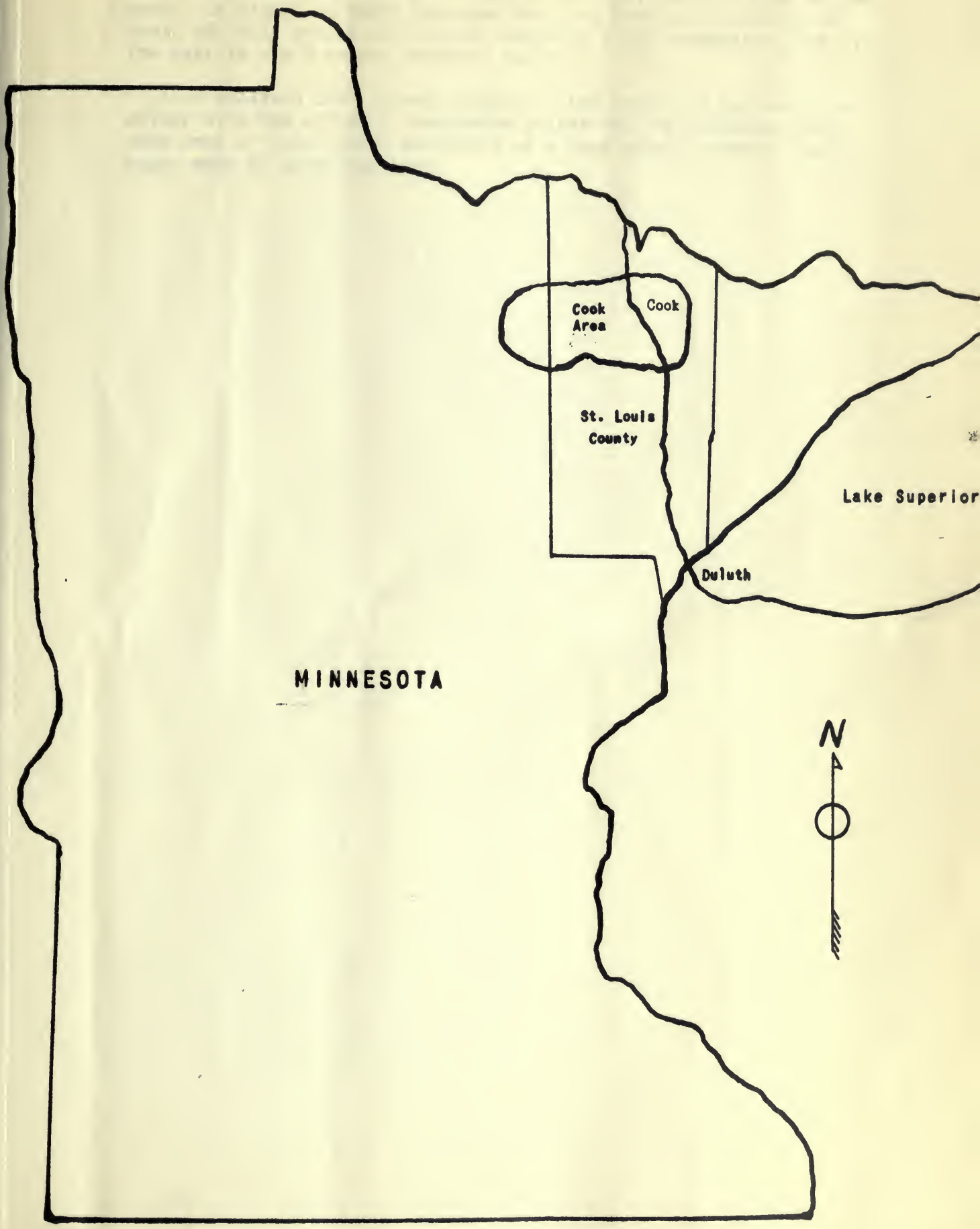
V - Geographical Location of Cook



VI - Conclusion

The Planning Board feels that the committee has brought out the fact that there is a tremendous volume of Aspen and Jack Pine in the area. It wishes to point out also that the area is tributary, in fact, the only outlet for virgin timber of eight townships lying to the east in the Superior National Forest.

It is believed that a ready market in the center of the area, together with the offer of reasonable prices for the products, will make most of this timber available to a wood using industry, which might want to establish here.

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THE MEANING OF CONSERVATION[1]

M. B. Dickerman[2]

1/ A talk given at the annual meeting of the Western Farm Economics Association, Pullman, Washington, June 28, 1950.

2/ Chief, Division of Forest Economics, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana.

Some Definitions and Concepts

Perhaps it will seem presumptious for me to spend half an hour discussing the meaning of conservation when Webster's dictionary defines the word in eight or ten lines. I am sure you will agree, however, that a dictionary definition is not much help in developing a concept of what is involved in the conservation of our natural resources. Neither are most of the definitions which have been prepared by economists and conservationists over the years. Satisfactory as some of them may be, we still face the problem of giving meaning to the concept - of dissecting and explaining the definitions.

An early discussion by one author says, "Conservation means the greatest good for the greatest number - and that for the longest time." Another author suggests, "that the heart of the conservation problem is the determination of the proper rate of discount on the future with the respect to the utilization of our natural resources." Someone else has said that "conservation is not an activity or an operation, but a principle or philosophy." These statements lead me to believe that the economist was right who stated that "the word 'conservation' seems impossible of final definition for its meaning changes with both time and place."

This evening I will not attempt to define the word conservation, but will discuss instead some of the broad aspects involved in the conservation of our natural wild land resources. Everyone will agree, I think, that what we are trying to do in our conservation effort is to maintain all of our natural renewable resources sufficiently productive that the people in this country will never suffer from the lack of the benefits they should obtain from their resources.

There are two general concepts of how that might be accomplished. The first, and perhaps older of the two, is that of minimizing use so there will be more of a given resource for future generations. This is the savings bank idea - putting away for safekeeping for future use. Such a concept perhaps has utility when we are thinking of the non-renewable resources such as metals, oil, and coal. It has also cropped up repeatedly in connection with the renewable resources. For example, some 200 years ago stands of oak in Florida were set aside for ship timbers so that the Navy would have an adequate future supply.

The weakness of this savings bank idea is apparent to even the layman. There is real reason to doubt that it has any place in the management of our renewable resources such as timber and forage. In the forestry field we have learned through experience and research, that there is in general more to gain in maintaining a thrifty growing stand than there is in holding on to an overmature one. The forests and all other renewable resources are subject to the forces of destruction. Plants and animals cannot indefinitely be stored on the stump or hoof. Diseases, insects, fire, old age, or some other factor removes them from the scene. Furthermore, just as a mowed lawn grows better than an unmowed one our renewable resources are in general more productive when used than when locked up for posterity. Foresters have proved, for example, that by increasing the number of trees on an acre of land and by cutting trees when they have reached their maximum current annual growth, cellulose yields can be more than doubled over what is found in an unmanaged

forest. Likewise, land managers have devised ways and means of increasing the annual water yield of wild land by manipulating the vegetative cover.

Present-day Concept of Conservation

The other concept of conservation arises out of the realization that renewable resources can be used and built up at the same time. It might be stated this way: Our natural resources should be currently used and managed so as to maximize their productivity and long-run contribution to society. The emphasis in this case is on use instead of saving. To apply such a concept calls for skill, understanding, and basic knowledge, for not only are biological factors involved, but also economic and social interrelationships. Nevertheless, this is the only acceptable concept if we want this country to make the most of its economic potentialities.

Conservation at its best is the antithesis of exploitation, which we usually think of as capital depletion over a short period with little or no provision for continuity of resource benefits. A major element in sound conservation is the time factor, the taking into account of the rate of replacement through biological processes and the immediate and future need of society for a given resource.

Multiple Use of Wild Lands

Almost all land can be put to more than one kind of use. In applying the principle of conservation one is forced to give full consideration to the varied beneficial uses to which the land can be put - uses which are often complementary but more often overlap or conflict. True application of conservation must achieve a balance between them. This usually is attainable, not through dedication of the land to only one use, but to its assignment to two or more uses. This is known as "multiple use" and its application is the key to conservation on wild lands.

Multiple use of wild land means different things in different places, but most commonly in this region it involves three resources: water, timber, and forage. To maximize the productivity of one may mean to reduce the use of another. To have more water for power and irrigation in the Northwest may mean less timber. To maximize forage yields may also mean less timber, or conversely, to have more timber may mean less forage and less water. Thus, what we do with one resource has an effect on another. Generally speaking, we cannot have maximum productivity of all renewable resources on a given area. What we strive for, of course, is to maintain the balance that produces the greatest net social benefit. It is in the manipulation of the several resources to secure the greatest net benefit that we become involved in so many intricacies and complications that multiple use of wild land is regarded by some administrators as multiple confusion.

If it is not confusing, it certainly is complex. The more experience we have the more we realize that conservation of wild land is an involved management job. For example, we cannot decide to grow timber and forget about the water and we cannot decide to produce the maximum desirable flow of water and forget about the timber. Both resources are vitally important so we must manage for both. I think it is safe to say that the biggest problem in wild land administration in the Northwest today is to obtain the type of management needed for desirable multiple-use benefits.

Development of Conservation in the United States

During the earliest days in this country a few farsighted individuals expressed concern over the depletion and injury of the natural resources. Nevertheless, the number of conservationists for a long time in the history of this country was very small. Only in the last half century has the conservation idea become an important part of our national thinking. As far back as 1890 the American Association for the Advancement of Science petitioned the President to appoint a commission to investigate the necessity of preserving certain parts of the present forest land as a requisite for the maintenance of favorable water conditions. The first concrete step in true conservation was the setting aside of forest reserves in the West. These later became what are known today as national forests. The organic act providing for administration of these lands was passed in 1897 and stated that national forests could be established only to (1) secure favorable waterflow conditions and (2) provide a continuous supply of timber.

Again in 1911, with the passage of the Weeks Law, this Nation took another forward step in spelling out conservation policy affecting wild land: The Secretary of Agriculture was directed, not just authorized, to purchase forest lands in watersheds of navigable streams, when the Secretary found federal control of such lands would favor navigation. It is interesting to note that the multiple-use idea was present in the early stages of conservation and as administrative policy has developed, the idea has broadened. Today we find public agencies taking into consideration not only water and timber, but also forage, recreation, and wildlife. The Forest Service, Soil Conservation Service, Bureau of Land Management, Bureau of Reclamation, state conservation departments, and other public agencies have been established as the conservation program has developed and rounded out.

Though conservation has come a long way in 50 years we still have a long way to go. For one thing the job has been tackled piecemeal, plugging first at one item then at another. The result is, that lacking an integrated approach, we now find some resources being developed at the expense of others, that a greater national effort may be going into one resource than is desirable at the present time, whereas other phases of conservation with less appeal are neglected.

So far as most publicly owned wild lands are concerned one can say that there is an intent to manage these lands so as to keep them highly productive. There is a positive policy of conservation for these lands. The trouble is that action has trailed far behind policy. Americans as a group have yet to realize that management of some 400 million acres of public land is a very big job.

Conservation on private lands poses a different sort of problem - the reconciliation of private and public interests and obligations. Generally speaking, the use of natural resources for private and public interests conflicts, and conflicts sharply. Frequently, what seems to be good for the individual may not be so good for society. Private ownership carries with it the privilege to use wisely or to misuse a resource. To attain wise use in the field of resource conservation calls for a public policy which redeems public responsibility to private landowners, and likewise, calls for the individual to raise his sights.

Fortunately, in forest and soil conservation some steps in this direction have already been taken. In the forestry field the Clark-McNary Act of 1924 provided for public assistance to private forest owners when the private owner meets certain conditions. This partnership, in achieving conservation, was a major forward step in public policy. What is needed now is a furtherance of this principle.

The idea that there are minimum conservation standards which every private owner of wild land should be expected to meet has been slower to take hold. However, in recent years several progressive states have undertaken to give at least some degree of protection to the public by passing regulatory laws setting minimum standards of forest practices.

You may ask to what may we attribute progress in conservation on wild land during the past half century. It seems to me that the basic reason has been a growing awakening as to the significance of conservation to national prosperity and security. I say "growing awakening" because as a nation we are certainly not yet fully cognizant of the stake we have in conservation of wild land resources.

Conservation in the Inland Empire

So far I have been talking in generalities. Let's take a look at the Inland Empire and consider some of the things involved in wild land conservation. When I speak of the Inland Empire I am thinking of that part of Montana west of the Continental Divide, the panhandle of Idaho and a half dozen counties in the eastern part of Washington. Although we see fertile agricultural lands around Moscow and Pullman, only 10 percent of the Inland Empire is cultivated. Another 10 percent is range land, and 80 percent is forest. Going eastward from here you climb to rough mountainous terrain much of which is inaccessible.

Ten years ago if you had asked the average forester what is the principal product of the Inland Empire forests he would have said "timber" without any hesitation. Ask him today and he'll unhesitatingly say "water." This remarkable change of view is part of a growing recognition of the importance of water over the Nation. But that is not the whole answer. Here in the Columbia Basin we have long recognized the importance of water. The Grand Coulee Dam has dramatized the fact. Most everyone realizes that because the oil and coal resources of this region are limited, the key to future industrial development is hydroelectric power. We know too that great untapped agricultural opportunities in the Northwest are in the several million acres awaiting irrigation. However, the importance and the availability of water has been pretty much taken for granted.

The Columbia River flood of 1948 with its loss of life and extensive property damage did as much as anything to jolt us out of our complacency. It emphasized, as perhaps nothing else could, that water management means not only dams, but dams complemented with desirable land use practices. We want to avoid falling into the predicament of trying to conserve water with a row of cups along the edge of a tin roof. For the wild lands wherein most of the water originates we need to apply intensive land management practices to have an effect on streamflow.

Wild land managers have a considerable fund of basic knowledge when it comes to growing timber, grass and wildlife. They know far less about how to make the timbered areas in particular perform like a well-regulated irrigation system.

The fundamental relationships between forests and water are pretty clear. We know that in a well-managed forest precipitation is absorbed by the loose, porous soil. The mere presence of trees acts as a mechanical hindrance to runoff. Where there is a dense vegetative cover snow melt is retarded and where the cover is removed, percolation is lessened, and surface runoff accelerated. When the forest soils are functioning properly the flow of mountain streams is better stabilized and water is laden with less silt than if it originated through surface runoff. We know also that the forest charges for its service. It uses some of the water for tree growth. Then too, the forest, through cover interception of snow and rain, tends to increase evaporation.

Our trouble comes in developing practices for taking advantage of these relationships. What do we want to achieve in watershed management of wild lands? First, we seek to keep our streams clear - free of sediment. Second, we seek to reduce the frequency and severity of floods by keeping low seasonal peaks in waterflow. Third, is to time the waterflow to the extent possible so as to have it coincide with the periods of greatest need for irrigation and power. This is a nice little problem in logistics because the greatest need for power is in the winter and the greatest need for irrigation water is in the summer. A fourth objective is to maximize the useful runoff. This is not so important now but it will be in the future. The Bonneville Power Administration tells us that the annual power requirements of the Columbia Basin in 1960 may be 10 times what they were in 1940. We are told also that the irrigated area in this Basin should be doubled over what it was in 1939, in which case the water requirements would be more than doubled. The fifth objective, and certainly not the least, is to keep the soil in place. We want to avoid anything like what I once saw in Italy. Two Italians were toiling on a hillside. One was lugging soil from a stream bed back up a mountain slope to a once productive field. His partner was carrying stones down the mountainside and building check dams to retard runoff.

It does not take much imagination to realize how complicated is the job of regulating forest cover to reduce floods but at the same time increase useful runoff without damaging the soil or impairing the quality of the water. We have a lot to learn in forestry about how, when, and where to cut to achieve these purposes. It means our fire protection standards and programs must be geared to watershed needs as well as timber-growing needs. At one time our subalpine forests were considered to be of little value. Some day we may decide that because of the snow which falls on such areas the trees on them are the most valuable in the region.

Water is only one product of the forest land. There is a major job of reconciliation between the several resources and their use. In our national forest wilderness areas the objective has been to keep them as true preserves - untouched and undeveloped. The importance of these back-country areas from a water supply standpoint may force an adjustment in this policy. In some cases it may be necessary to go into these areas to plant and build revetments. How far we may have to back away from the wilderness idea is a nice technical question.

The big reconciliation job, of course, is between water supply and timber growing. Though timber values have, in recent years, been overshadowed by water values they nevertheless have played a tremendously important part in the growth and development of the region. The forest has a 100-million-dollar industry dependent upon it, an industry which is one of the main props of the local economy.

So far as possible forest land managers should attempt to produce large timber yields of high quality. Yet we find that the management best suited for timber production is not in all cases the best for water supply. One or the other or both must give. For example, the protection of streams very often requires leaving strips of timber from which the yields at best will be reduced. In many cases the intensity of cutting which is most economical for the logger is too heavy for good watershed protection. As loggers move from the lower more accessible forest areas to the more rugged mountainous country management problems multiply. Greater care must be taken to avoid erosion and rapid water runoff.

As if the complexities of managing for multiple use were not sufficient, timber growing in the Inland Empire is involved and complicated by economic considerations. Two species, white and ponderosa pines, make up one third of the timber stand but supply about one half of the timber cut. They have literally been the backbone of the lumber industry. You say, "Fine. Let's grow more white and ponderosa pines and less of the other species." One drawback is that the two pines commonly grow in association with other species. To grow succeeding crops of pine it is necessary to get rid of the other timber occupying the space we want to use for growing the pine. The markets for the other species have historically been inadequate. Thus, instead of increasing as it should, the acreage of white and ponderosa pine types has been diminishing for a half century.

White pine is the most valuable species we have. Yet, it is very provincial. It just cannot be moved around very much. Furthermore, it is a rather weak soul - a prey for many pests. Over the past quarter century we have spent millions of dollars to protect it from the blister rust disease. Now a new disease known as pole blight has come along which is killing young white pine. Conservation in this case involves finding a means of controlling the pole blight. It means deciding where it is economical to grow white pine in the face of blister rust.

You might conclude that we had better forget about white pine in the Inland Empire and grow our timber elsewhere. But it is not so simple; no more than it would be to replace wheat production here in the Palouse by moving wheat culture to the rocky rolling hills of New England. Furthermore, if national timber needs are to be met, we need high productivity of all timber lands in all forest regions.

I could go on and recite more complexities of wild land management. There are many. What I have said is sufficient, however, to emphasize that merely to speak of conservation as "wise use" of natural resources is to oversimplify it. We can better describe wild land conservation as the big and challenging job of so managing and manipulating the resource as to produce the greatest and most desirable composite of benefits. It is a job we will never do to

our complete satisfaction because of the complexity of the interrelationships - both ecological and economic.

In my estimation, wild land conservation may be divided into two parts. The first one - one in which you economists should participate actively - is the interpretation of the needs of this country in terms of the desirable combination of benefits. As in every other activity there is a limit as to how far this country can go in conservation. We need to be sure our efforts are expended where they will do the most good, recognizing that the intangible or nonmeasurable values will in many instances be the principal benefits to be obtained. The second phase of conservation is to develop and effectuate programs which will accomplish the desired end efficiently and in keeping with the benefits to be attained.

What Happens When Conservation is Neglected

At this point I wouldn't be surprised if you were prompted to ask what the desired end is. My answer would be simply this, "A stronger, more secure and prosperous United States." That is the ultimate objective of conservation and technicians have a tremendous task pursuing this objective. Not so long ago I spent the better part of two years in Greece and Italy. The things I observed in those two countries are an excellent illustration of what not to do, of what happens when society is wasteful and neglects conservation.

Both Greece and Italy centuries ago rose to world domination only to fall back into economic and political chaos. Historians and economists agree that to a large degree this fall and the recent chaos are basically the result of long-time resource depletion. Evidences of soil, timber, and forage decline are everywhere in these countries. To be sure, they never had the bountiful supply of natural resources that we in this country inherited, but it is almost trite to say there has been neglect. The end result is startling. Today these two countries are just bogged down trying to eke out an existence, to get enough food, fuel, and shelter so that human life can exist.

In Greece, for example, in many mountain villages - and more than three fourths of the people live there - at least one person in each family spends his full time bringing in fuelwood just to cook two scanty meals a day. In this country very few of us spend more than a week or two of our wages for cooking fuel. Throughout most of Greece oak brush is the only forage for livestock, and even the goats have a hard time getting by on this. In some areas the goats give less than 60 quarts of milk per year, whereas here we expect at least a quart of milk per day. I can assure you that their brush-fed goats are not very palatable. Grain crop yields are low too. Irrigated wheat lands seldom yield more than 20 bushels.

In Italy the story is much the same, although not so bad as in Greece. Traveling through southern Italy, one is startled by the miles and miles of barren, denuded mountain land. When you see a peasant carrying soil back up on to the hillside you cannot help but know something has gone wrong. To be sure, there are rich, deep, fertile soils on the narrow coastal plains, but again one wonders how much more food and forage there would be if this soil were spread out over the countryside. Patches of cultivated land, except for the coastal plains, are seldom more than two to five acres

and because of their small size these fields cannot be tilled to advantage with machinery. The Italians are deeply concerned over their water problems - irrigation, drainage, and flood control. In the Pontine marshes, for example, where millions of lire have been spent, there is a three-way water system - canals to drain the marshes, containment walls and viaducts to carry the mountain flood water across the marshes to the sea, and irrigation canals to water the agricultural lands. This is just one example of how difficult life becomes when our natural resources get out of hand, when conservation as national policy is neglected.

In both countries the effects of resource depletion on the people and their social institutions are readily apparent. Poor diets, lack of housing and inadequate health facilities are resulting in physically weak and emotionally unstable populations and political unrest. These are the end results of neglect and disregard for natural resources, and in a negative way give a very pointed meaning to conservation.

To summarize, conservation means use - wise use of our natural resources for the benefit of society. To accomplish this is a complicated and involved task. To fail, though, is to admit that sooner or later we will join the impoverished countries.

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Summarization of Issues Raised

Foreword

The following summary is an attempt to define more specifically the principal issues and ideas advanced by various individuals in the discussions last year. It is expected that the group will wish to amplify, modify and otherwise revise this statement. It is submitted merely as a basis for discussion in the first meeting of this semester and as an attempt to bring into more concrete form the highlights of the meetings of last year. It would appear that a clearer defining of issues and concepts may make possible more orderly and rigorous consideration of specific phases in future meeti

The discussions of last year served to provide a better acquaintance with the outlooks of people from various disciplines and to uncover some of the major divergences in viewpoint. It is the opinion of several members of the group that we should now seek to move forward from that level of attack to more specific consideration of concepts and viewpoints in ways that might develop contributions for a wider audience.

Summary

The economists held forth in the earlier sessions and presented certain viewpoints but did not always agree with each other. The following are some of the points stressed:

That the period of soil exploitation is an historical stage in the maturing of a country. Extreme exploitation during this stage in north Europe was inhibited by the feudal organization of society. That later checks grew out of the scarcity of natural resources and the development of certain traditional attitudes toward the land, also out of the fact that outlets for agricultural people were limited. Hence they must safeguard the basic resource which meant to them a means of existence. Some exception was taken to the concept of feudalism here expressed.

Emphasis was given to the need for developing a more adequate basis for "social" cost accounting through clearer identification of social values arising from given activities and the social costs associated with actions or failures to act. A distinction was drawn between so-called "positive" and "negative" measures, the former designed to specify what shall be done, the latter what shall not be done.

Exception was taken to the view that another approach to future values than that based on discounted present values could be taken logically. This view held that the discounted future value provides the only rational means of determining distribution of present inputs. Those supporting this view would admit that government might logically check certain activities at times but that this would usually be a temporary expedient. No satisfactory common denominator for the social and the individual approach emerged from the discussions.

Stress was given to the view that the attainment of an ultimate value may justify destructive measures which hasten that process, as for example, the rapid and wasteful conversion of forests to farm lands, exhaustion of certain lands and moving on to new more fertile areas.

Discussion Group on Philosophy of Conservation
1937-38

Summarization of Issues Raised

Foreword

The following summary is an attempt to define more specifically the principal issues and ideas advanced by various individuals in the discussions last year. It is expected that the group will wish to amplify, modify and otherwise revise this statement. It is submitted merely as a basis for discussion on the first meeting of the semester and as an attempt to bring into more concrete form the highlights of the dialogue of last year. It could appear that a clearer delineation of issues can thus make possible more orderly and rigorous consideration of specific phases in future meetings.

The discussions of last year served to provide a better acquaintance with the outlooks of people from various disciplines and to uncover some of the major differences in viewpoint. It is the opinion of several members of the group that we should now try to move forward from that level of argument to more specific consideration of concrete viewpoints in ways that might develop contributions for a wider audience.

Summary

The colloquists held forth in the earlier sessions and presented certain views, points but did not always agree with each other. The following are some of the points stressed:

That the period of soil exploitation is an historical stage in the maturing of a country. Extreme exploitation during this stage in north Europe was intensified by the feudal organization of society. That later checks grew out of the scarcity of natural resources and the development of certain traditional attitudes toward the land. Arose out of the fact that outlets for agricultural people were limited. Hence they must safeguard the basic resource which meant to them a means of existence. Some parallel was taken to the concept of feudalism here expressed.

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Stress was given to the view that the attainment of an ideal state may involve destructive measures which harm that process, as for example, the rapid conversion of forests to farm lands, conversion of marginal lands [illegible] [illegible] [illegible]

The view was staunchly defended, however, that, from a national viewpoint, certain fundamental resources must be maintained; that the life of the nation must be assumed to be perpetual whereas the individual's concern with future values is limited roughly to his prospective life span. This latter view would appear not to have been challenged as much as it might have been.

No one undertook to state a principle governing the logical treatment of non-renewable resources.

A second line of discussion was carried mainly by the geographers and focussed on the general proposition that man, in his unwisdom, is a destructive force. He has desecrated the land and it is time to take an accounting. Some differences of opinion appeared as to the historical facts of the situation as follows:

1. The extent and intensity of erosion

2. Man's influence on this

There are certain natural processes of erosion and possibilities that seriously overgrazed conditions may have occurred before the advent of the white man, as in the heavy natural stocking with bison and other similar situations. To what extent are the fertile areas of eastern Nebraska and the Dakotas, Iowa and Minnesota wind-formed soils, and if so formed was it during the period just following glaciation when vegetation was scant? This whole problem centers upon the extent to which certain processes have been accentuated by man's use of these resources. What ecological changes in vegetation have actually occurred?

Some controversy developed as to just what has happened in North Africa and the Euphrates basin, and the implications for California's irrigated agriculture.

Opposition was expressed to planning by key men in institutionalized government agencies. A more decentralized mechanism was favored by those supporting this view, but a well-defined alternative did not emerge from the discussions.

Other distinctive points of view appeared in presentations by the soil and plant scientists. These may be roughly characterized in the following propositions:

1. That there are both differences and changes in soil structure and chemical composition which are as yet very inadequately understood. The soil chemist and the plant scientist cannot say with assurance either what given soils will produce effectivel or what the effects of given treatments will be. This discussion would appear to emphasi the need for caution especially in the so-called "positive" measures of planning and in programs such as that of the Agricultural Adjustment Administration in so far as these are really oriented to soil improvement or protection against fertility losses.

2. A second major proposition dealt with the broad regional correlation between soil composition and fertility and variations in temperature and rainfall. This approach brings into sharper focus important regional differences in the feasibility of soil-building measures. If accepted, it carries important implications with respect to region differentiations of program and the likelihood of returns commensurate with inputs in the various regions. This may be summarized as the basic physical and biological framework within which land-use planning must operate.

3. A third proposition dealt with the great variations in erosibility of differen soils and the implications of these differences in erosion control programs. Some soils

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will be ruined by almost any degree of intensive use while others with similar slope and rainfall may be almost immune to serious damage. This again would seem to challenge the wisdom of very widely generalized programs.

As a pioneering group in the field of conservation with an extensive development of policy and precedent it was natural that the foresters' views should appear in numerous aspects of the problem. The most direct treatments had to do, however, with:

1. The problems of recreational values and multiple use, and

2. Policies with respect to the so-called "wild lands" of California.

Under the first of these the growing demand for recreational uses of wild lands was stressed, and certain qualitative features of these values were presented. Specific proposals for evaluation of such uses were not attempted. This appears to be a field warranting further and more rigorous consideration.

Some difference, probably mostly terminological, appeared with respect to the concept of multiple use. This seems to call for clearer definition of viewpoints and concepts.

Under 2, above, a case was made for treatment of "wild lands" as a public utility because of the time factor, high nonmonetary values involved, low per acre values associated with danger of permanent deterioration. One view advanced favored private management with strong government regulation. Social justification for permitting a high degree of monopoly in the forest products field was a viewpoint advanced. Both of these propositions encountered considerable disagreement, particularly the second.

Further points set forth were:

1. Where private enterprise is ineffective there should be government ownership of wild lands.

2. All wild lands, the products or services of which are now needed, should be put under definite management. Other wild lands should be given sufficient protection to insure their maintenance.

3. Poorer lands must be developed for all uses to make any use feasible.

4. Some values arising from the use of wild lands are tangible and can accrue to the owner of the land; some are tangible and cannot so accrue; and some are intangible and cannot be measured by any means now known.

Not specifically advanced by any individual or group but running through the discussions was a search for clearer perception of relative spheres of public and private activity in conservation and for a more logical consideration of the functions of given units of government in the conservation program. What are the appropriate spheres of public ownership and public management, public ownership and private management, government regulation of private management, governmentally provided inducements to private activity, and mere education of private agencies and individuals?

Along with these might be discerned some questioning about how to prevent, under government ownership, preferential treatment of certain groups, and the warrant for associating certain groups of individuals with supposedly optimum units of resources while other and much larger social groups must achieve such resources through competitive private activity.

[illegible] A particular [illegible]

[illegible] planning [illegible] problems [illegible]. Differences [illegible] planning [illegible] in the [illegible] of planning [illegible]

[illegible] governmental [illegible] appropriately set up.

[illegible] comprehensive planning [illegible] is an [illegible] [illegible] to pay [illegible] This [illegible] the problem of [illegible] [illegible]

[illegible] is the basic goal in terms of population and standard of living?

[illegible] standards of living in [illegible] to envision not only [illegible] and services, but [illegible] values as independence, security, attractiveness of [illegible]

[illegible] have capital resources actually been depleted and to what [illegible] changed in form?

[illegible] have empires exhausted their resources and then disappeared [illegible] been due to other causes?

[illegible] do we mean by ownership?

[illegible] the things "of social significance" in the use of land?

Possible Topics for Paper

Conditions and forces contributing to decline of rural populations in [illegible] California areas.

[illegible] of depletion of fertility and outlook for restoration.

[illegible] and economic aspects of land destruction in placer and hydraulic [illegible]

The nature of social values implied in land-use planning.

Soil and resource conservation in America as a social and governmental [illegible]

Economic implications in erosibility of soils as it relates to soil conservation.

Establishing economic criteria in evaluating biological factors in land-use [illegible]

Approaches to land-use planning from a scientific point of view.

The search for an optimum balance in soil depletion and soil building.

Agricultural aspects of forest and wild land management.

Government mechanisms for developing land-use planning.

Gilliam county, Oregon. Land use committee

GILLIAM COUNTY OREGON

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LAND USE REPORT 1941

Prepared By
County Land Use Committee
In Cooperation With Oregon State College
and
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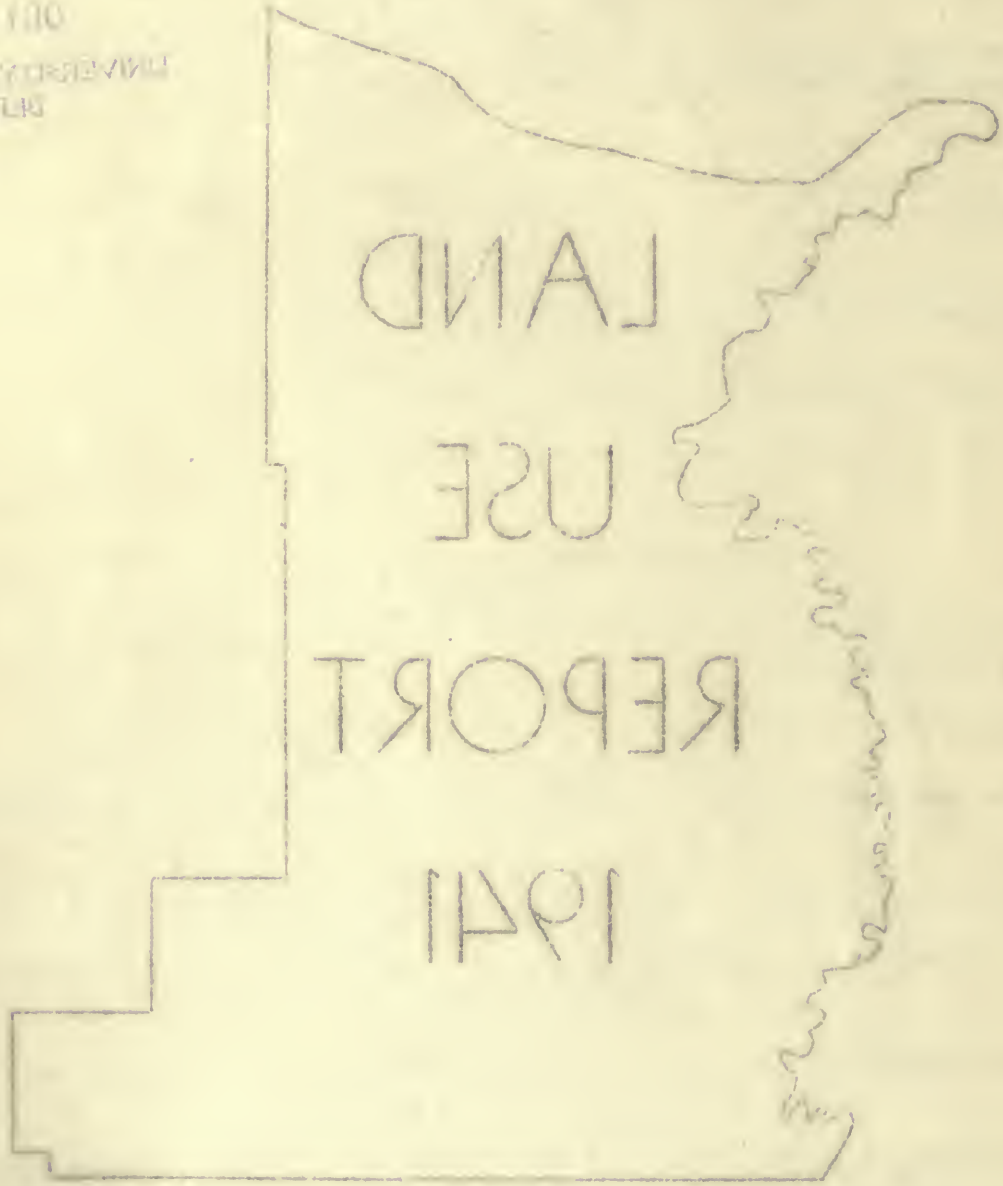

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The following intensive report of the Gilliam County Land Use Committee includes the land use problems and recommendations of the committee to date. The present situation is summarized along with the problems and recommendations preparatory to the development of a unified program in the county.

The committee wishes to acknowledge assistance and material for this report furnished by the following agencies: Agricultural Adjustment Administration, Bureau of Agricultural Economics, County Assessor, Extension Service, Farm Credit Administration, Farm Security Administration, Grazing Service, Soil Conservation Service, and State Tax Commission.

Signed: The Work Committee

C. A. Fish — Glen L. Richards

Chairman

W. F. Marshall — Loyde Smith

Secretary

C. R. Barker — Lester Harrison

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Gilliam County Land Use Organization

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C. A. Nish, Mikkalo, Chairman
W. F. Marshall, Condon, Secretary

Glen L. Richards
Lester Harrison
J. F. Reisacher
Earl P. Hoag
W. F. Woelpern
Lester Schaefer
R. W. Potter
Harry Myers
R. E. Irby

O. V. Reser
J. W. Dyer
Loyd E. Smith
M. E. Weatherford
F. C. Greiner
O. L. Lundell
C. K. Barker
H. H. McKinney
E. R. Fatland

Community Land Use Committees

Blalock

Earl P. Hoag, Chairman
W. F. Woelpern
Wm. Bartlemay

Lonerock

Lester Harrison, Chairman
J. G. Boyer
George Fichter

Olex

R. E. Irby, Chairman
M. E. Weatherford
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W. F. Woolpern	R. C. Goodner
Lester Schaefer	C. L. Lardell
R. W. Potter	R. R. Barker
Harry Byrd	J. R. McKinney
R. E. Lehr	W. S. Rutland

Community Land Use Committees

Ulalock

Karl F. Haag, Chairman
W. F. Woolpern
Wm. Hartleroy

Lonerock

Lester Harrison, Chairman
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Lisa

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INTENSIVE LAND USE REPORT, GILLIAM COUNTY OREGON

INTRODUCTION

Gilliam county is located in the north central section of the state of Oregon, approximately in the center of the Columbia Basin. It is bounded by the Columbia river on the north, the John Day river and Sherman county on the west, Wheeler county on the south, and Morrow county on the east. The incorporated towns in the county are Condon, which is the county seat and which has a population of 866; Arlington, with a population of 630; and Lonerock, with a population of 27.

Gilliam county has been organized for 55 years, having been created February 25, 1885, from parts of Wasco and Umatilla counties. Agricultural development in the county began in the period between 1885 and 1890.

Purpose

Land use planning work in Gilliam county has been conducted by the land use committees in order to determine and recognize problems relating to the agriculture of the county. It is the aim of this work, through the cooperation of the farm people, agricultural agencies, and others, to secure the best use of the land in order to provide maximum returns over a long period of time, not only to the farmers themselves but to those engaged in other lines of work in Gilliam county.

This report is issued in order to summarize the present situation in Gilliam county and to list the major problems, together with recommendations, preliminary to developing a unified program for agricultural agencies.

Development of Land Use Planning, Procedure Used, and County Organization

In a number of the counties in the state land use planning work had its background in the economic conferences which were held intermittently starting in 1924 and 1925. However, the first economic conference held in Gilliam county was in 1938. At that time land use was considered as a special problem and a land use committee was one of the four special committees appointed. The report of the recommendations of this committee was published in the Report and Recommendations of the Gilliam County Economic Outlook Conference, February 25, 1938.

In the fall of 1938, because of the importance of studying land use problems, the land use committee of the economic conference was made a permanent committee. In March 1940, with the assistance of the Extension Service the land use committee held community meetings in each of the four communities of the county. At these meetings the purpose of the land use planning work was explained and community committees elected. The community committees, after

INTENSIVE LAND USE REPORT, GILLIAM COUNTY
OREGON

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studying the land use situation in their communities made reports to the county land use committee.

In October of 1940 a work committee was selected from the county land use committee to coordinate reports of the community committees and to prepare the intensive land use report.

The land use planning organization in Gilliam county is as follows:

Program Planning Committee for the 1938 Economic Conference
County Land Use Committee
Land Use Work Committee
Community Committees in the Olex, Blalock, Condon, and Lonerock communities

PRESENT AGRICULTURAL SITUATION

Physical Features

The total area of Gilliam county is 768,640 acres, of which 265,000 acres have been considered as tillable land although only 245,000 acres of this are actually cultivated at the present time. At present, 2,400 acres in the county are irrigated, the remaining 242,600 acres being cultivated under dry-land conditions.

The topography of the county is that of a long plateau rising rapidly southward from the Columbia river. The elevation varies from 237 feet at Blalock, which is located on the Columbia river, to 3,114 feet at Lonerock in the extreme southern part of the county. The county is cut up by numerous deep and rough canyons.

The average growing season in the county is 205 days. Precipitation data are shown in Table No. 1.

Table No. 1
Record of Precipitation in Gilliam County

	Average Yearly Precipitation	Highest Yearly Precipitation	Lowest Yearly Precipitation
Arlington			
28 yr. rec. ending 1939	8.83	12.96	5.02
Condon			
32 yr. rec. ending 1939	11.88	17.59	6.58
Lonerock			
16 yr. rec. ending 1906	14.44	17.77	10.72

Arlington is located in the northern part of the county on the Columbia river, Condon near the central part, and Lonerock in the southern part.

The native vegetation of the county consists largely of bunchgrass (*Agropyron spicatum* and *Agropyron inerme*), other grasses and sage, although in more recent years due to drouth and overgrazing some of the bunchgrass cover has been seriously depleted and replaced by cheatgrass.

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The important soils of the county have been divided into four groups which are described as follows: 1/

Soils resembling the Ritzville series which vary in texture from a loam to a loamy fine sand make up the first group. The surface of these soils is ordinarily a light brown or grayish brown, floury and friable. The subsoil is cream colored and is more compact than the surface soil.

The second group is made up of soils resembling the Waha soils. They are residual soils on basalt. The surface soils are very dark brown, friable silt loam or loam to a depth of eight or ten inches. The subsoil is a grayish brown or very dark dull brown clay or silt loam.

The alluvial soils of the county are grouped together to make the third group. They vary in texture from silt loam to fine sand and in color from brown to brownish gray.

Soils which resemble the Ephrata, Rupert, and Winchester series make up the fourth group. They have been derived from water-laid materials in the Columbia Basin and have been reworked by wind and water. They are underlain by coarse sand and gravel or cobbles. They are light brown or light grayish brown in color. In texture they vary from fine sandy loam to coarse sand. They are highly susceptible to wind erosion.

The lighter soils are located largely in the northern part of the county and are generally deep. The heavier and shallow soils are located in the southern part.

Economic and Social Features

Population

Total population in Gilliam county has been decreasing since the 1920's as is shown in the following table. The high point of farm population was reached in 1930.

	1910	1920	1925	1930	1935	1940
County Population	3,701	3,960		3,467		2,830
Farm Population			1,668	1,691	1,387	1,401

Land Use

Wheat is the principal crop grown in Gilliam county. The production of other crops is relatively unimportant, although crested wheatgrass seedings have increased in recent years. On irrigated land alfalfa is the principal crop produced. Information on 1940 land use is given in Table No. 2.

1/ Soil Conservation Service Soil Reconnaissance Survey of Gilliam county.

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Table No. 2
1940 Land Use of Cultivated Land, Gilliam County

	Grain Acres	Hay Acres	Total Acres
Winter wheat	91,291	2,491	93,782
Spring wheat	13,586	427	14,013
Barley	7,942	1,014	8,956
Rye	964	1,373	2,337
Oats	580	237	817
Mixed grains	4,430	2,330	6,760
Corn	35		35
Alfalfa		1,480	1,480
Clover		20	20
Annual crops pastured			2,560
Grass mixtures			125
Crested wheatgrass			10,500*
Potatoes			15
Summer fallow, clean			58,294
Summer fallow, trashy			42,252
Total summer fallow			100,546
Idle			3,054
Total cropland			245,000

*This acreage is not included in the 20,000 acres permanently seeded to crested wheatgrass referred to in Section C, Page 13.

Land Ownership

There are 687,674 acres of privately owned lands in the county and 80,966 acres in public ownership. Of the privately owned cultivated lands 31.5 percent is owned by absentee landowners. The public domain is largely non-tillable.

Number of Farms

Information on the number and size of farms in the county is as follows:

Total in county	299
Average size (acres)	2,267
Average number acres cultivated	939
Irrigated farms	44
Dry-land farms	255

Number of Livestock

Livestock production in Gilliam county is important principally because of the intermixed range and cultivated land. Estimated livestock numbers as of January 1, 1941, include 2,000 horses, 90 mules, 10,800 beef cattle, 1,200 dairy cattle, 73,000 sheep, and 2,800 hogs.

Public Improvements

Rail transportation in the county is furnished by the main line of the Union Pacific Railway, which runs through the extreme northern part of the county, and a branch line running from Arlington to Condon.

Table No. 2

1940 Land Use of Cultivated Land, Gilliam County

	Grain Acres	Hay Acres	Total Acres
Winter wheat	91,791	2,471	93,789
Spring wheat	13,585	427	14,013
Barley	7,942	1,014	8,956
Rye	964	1,373	2,337
Oats	580	237	817
Mixed grains	4,430	2,330	6,760
Corn	35		35
Alfalfa		1,480	1,480
Clover		20	20
Annual crops pastured			2,560
Grass mixtures			125
Crested wheatgrass			10,500*
Potatoes			15
Summer fallow, clean			58,294
Summer fallow, trashy			42,252
Total summer fallow			100,546
Idle			3,054
Total cropland			245,000

*This acreage is not included in the 20,000 acres permanently seeded to crested wheatgrass referred to in Section C, Page 13.

Land Ownership

There are 687,674 acres of privately owned lands in the county and 80,966 acres in public ownership. Of the privately owned cultivated lands 31.5 percent is owned by absentee landowners. The public domain is largely non-tillable.

Number of Farms

Information on the number and size of farms in the county is as follows:

Total in county	299
Average size (acres)	2,267
Average number acres cultivated	939
Irrigated farms	44
Dry-land farms	255

Number of Livestock

Livestock production in Gilliam county is important principally because of the intermixed range and cultivated land. Estimated livestock numbers as of January 1, 1941, include 2,000 horses, 90 mules, 10,800 beef cattle, 1,200 dairy cattle, 73,000 sheep, and 2,800 hogs.

Public Improvements

Rail transportation in the county is furnished by the main line of the Union Pacific Railway, which runs through the extreme northern part of the county, and a branch line running from Arlington to Condon.

U. S. Highway No. 30 passes east and west through the northern part of the county parallel to the railroad, and State Highway No. 19 runs north and south through the county. There is one secondary highway which goes through the county from Moro to Heppner. There are approximately 684 miles of county roads.

Schools in operation in the county include two high schools, one at Condon and the other at Arlington, and nine grade schools. In addition there are 26 inactive grade schools.

There are 19 farm homes in the county which are served by electric power lines at the present time. It was estimated in 1938 that 25 farm families who reside within one mile of power lines did not receive electricity. 2/ At the present time a Rural Electrification Administration unit is being considered by farmers residing in Gilliam and Morrow counties. There are more than 100 signers in favor of this development in Gilliam county and possibilities of establishment of the unit are favorable. The definite boundaries of the territory that will be included are not established at present. In many parts of the county because of the great distance between farms, rural electrification through the REA does not at present seem possible. Such development is limited to the more thickly settled areas, although where power lines are established large farms which are located at some distance may obtain power by building lines to areas already electrified.

Public Finance 3/

The total assessed value of taxable property in the county in 1938 was $9,385,655.63, which was a slight increase over the assessed value for 1937 but a decrease of $4,138,970 from the assessed value for 1930. Gilliam county ranks thirtieth of the 36 counties in Oregon in assessed valuation for the year 1938.

The average assessed value of tillable land in the county for 1937 was $15.45 per acre and for range land $1.97 per acre.

Total tax delinquency in the county on December 31, 1937, for taxes levied up to and including 1936 was $310,815,16. Of this amount, 68.8 percent was delinquent in 1933 and prior years, 15.1 percent in 1934, 6.5 percent in 1935, and 9.6 percent in 1936. Fifteen and four-tenths percent, $29,868.69, of the taxes levied in 1936 were delinquent in December, 1937.

The tax levy for 1940 for Gilliam county is $188,580.86. The 1939 levy was $181,072.71. The lowest levy for the past 20 years was the $176,389.70 levied in 1938. In 1927, the high year of the 20 years studied, the levy was $301,445.

The total public debt for the county in 1938, including school districts, incorporated cities, roads, bridges, and general fund, was $246,736.59, which is 1.9 percent of the value of the taxable property for the year 1937.

Agricultural Income

Approximately 65 percent of the agricultural income of the county is obtained from field crops and 35 percent from animal products. Of the total agricultural income at least 62 percent comes from one crop - wheat.

2/ Report and Recommendations of Gilliam County Economic Outlook Conference, 1938.
3/ Data from Fourteenth Biennial Report of State Tax Commission, 1939.

U. S. Highway No. 20 passes over and west through the northern part of the county parallel to the railroad, and State Highway No. 19 runs north and south through the county. There is one secondary highway which goes through the county from Nye to Bryson. There are approximately 1024 miles of county roads.

Schools in operation in the county include two high schools, one at Condon and the other at Arlington, and nine grade schools. In addition there are 26 parochial grade schools.

There are 19 farm homes in the county which are served by electric power lines at the present time. It was estimated in 1929 that 25 farm families who reside within one mile of power lines did not receive electricity. 2/ At the present time a Rural Electrification Administration unit is being constructed by farmers residing in Gilliam and Morrow counties. There are more than 100 adopters in favor of this development in Gilliam county and negotiations of establishment of the unit are favorable. The definite boundaries of the territory that will be included are not established at present. In some parts of the county because of the great distance between farms, rural electrification through the REA does not at present seem possible. Such development is limited to the more thickly settled areas, although where power lines are established farms which are located at some distance may obtain power by building lines to farms already electrified.

Public Finance 3/

The total assessed value of taxable property in the county in 1929 was $9,285,655.63, which was a slight increase over the assessed value for 1927 but a decrease of $4,339,970 from the assessed value for 1930. Gilliam county ranks thirtieth of the 36 counties in Oregon in assessed valuation for the year 1929.

The average assessed value of tillable land in the county for 1927 was $15.45 per acre and for range land $1.27 per acre.

Total tax delinquency in the county on December 31, 1927, for taxes levied up to and including 1926 was $[illegible],15[illegible]. Of this amount, 60.9 percent was delinquent in 1923 and prior years, 15.3 percent in 1924, 6.5 percent in 1925, and 9.6 percent in 1926. Fifteen and four-tenths percent, $29,[illegible].59, of the taxes levied in 1926 were delinquent in December, 1927.

The tax levy for 1930 for Gilliam county is $[illegible],580.86. The 1929 levy was $121,072.71. The lowest levy for the past 20 years was the $117,[illegible].30 levied in 1918. In 1927, the high year of the 20 years studied, the levy was $[illegible].

The total public debt for the county in 1929, including school districts, incorporated cities, roads, bridges, and general fund, was $246,726.59, which is 1.9 percent of the value of the taxable property for the year 1927.

Agricultural Income

Approximately 85 percent of the agricultural income of the county is obtained from field crops and 15 percent from animal products. Of the total agricultural income at least 60 percent comes from one crop - wheat.

2/ Report and Recommendations of Gilliam County Economic Outlook Conference, 1929.
3/ Data from Fourteenth Biennial Report of State Tax Commission, 1929.

Table No. 3
Gilliam County Agricultural Income, 1936-37*

Enterprise	Average Income	Percent
1. Wheat	$1,100,000.00	62.0
2. Sheep	325,000.00	18.0
3. Cattle	264,000.00	15.0
4. Hogs	36,000.00	2.0
5. Dairy Products	22,000.00	1.2
6. Other Products	35,000.00	1.8
Totals	$1,782,000.00	100.0

*Report and Recommendations of Gilliam County Economic Outlook Conference, 1938.

Fifty-three percent of the employment in Gilliam county is agricultural. The balance is distributed in amounts varying from one to eight percent in the various industries and professions.

COUNTY-WIDE AGRICULTURAL PROBLEMS

Farm Credit

Explanation of the Present Situation

Local financing in Gilliam county is divided between private banks located at Condon, Fossil, and The Dalles; the National Farm Loan Association and Production Credit Association at The Dalles; and the Farm Security Administration at Pendleton. The amount of emergency seed loans made is negligible as there is only an average of two cases per year.

The Federal Land Bank through the National Farm Loan Association has been the principal loaning agency in the county for real estate. Since 1917 it has made 251 Federal Land Bank loans and 56 Land Bank Commissioner loans in Gilliam county. At the present time there are 146 Federal Land Bank loans and 41 Land Bank Commissioner loans outstanding in the county. There are Federal Land Bank loans on about 12 percent of the cultivated acreage in the county and Land Bank Commissioner loans on approximately another 12 percent. The loan experience of the Federal Land Bank in the county, which is summarized in Table No. 4, shows that the largest number of loans was made during the years 1917-1923. There was a considerable drop in the number of loans from 1924-32, and including Land Bank Commissioner loans an increase occurred during the period 1933-39. The average amount of cultivated acreage per farm to which loans were made shows a considerable increase during the three periods as shown in Table No. 5. As is shown in this table, the average size of the loan has not varied materially for Federal Land Bank loans. As is shown in Table No. 4, the larger portion of the loans has been made to wheat farmers during all periods.

The Federal Land Bank now owns only four farms in Gilliam county, which include 3,529 acres of land and which can be purchased as one unit. Although 70 loans have been foreclosed during the 22-year period, 1917-1939, most of these lands have been disposed of through sales.

Table No. 3

Gilliam County Agricultural Income, 1930-32a

Enterprise	Average Income	Percent
1. Wheat	$1,100,000.00	62.0
2. Sheep	325,000.00	19.0
3. Cattle	264,000.00	15.0
4. Hogs	36,000.00	2.0
5. Dairy Products	22,000.00	1.2
6. Other Products	15,000.00	1.8
Totals	$1,752,000.00	100.0

Report and Recommendations of Gilliam County Economic Outlook Conference, 1933.

Fifty-three percent of the employment in Gilliam county is agricultural. The balance is distributed in amounts varying from one to eight percent in the various industries and professions.

COUNTY-WIDE AGRICULTURAL PROBLEMS

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The Federal Land Bank through the National Farm Loan Association has been the principal loaning agency in the county for real estate. Since 1917 it has made 251 Federal Land Bank loans and 56 Land Bank Commissioner loans in Gilliam county. At the present time there are 146 Federal Land Bank loans and 41 Land Bank Commissioner loans outstanding in the county. There are Federal Land Bank loans on about 12 percent of the cultivated acreage in the county and Land Bank Commissioner loans on approximately another 12 percent. The loan experience of the Federal Land Bank in the county, which is summarized in Table No. 4, shows that the largest number of loans was made during the years 1917-1923. There was a considerable drop in the number of loans from 1924-32, and including Land Bank Commissioner loans an increase occurred during the period 1933-39. The average amount of cultivated acreage per farm to which loans were made shows a considerable increase during the three periods as shown in Table No. 5. As is shown in this table, the average size of the loan has not varied materially for Federal Land Bank loans. As is shown in Table No. 6, the larger portion of the loans has been made to wheat farmers during all periods.

The Federal Land Bank now owns only four farms in Gilliam county, which include 3,529 acres of land and which can be purchased as one unit. Although 70 loans have been foreclosed during the 22-year period, 1917-1939, most of these lands have been disposed of through sales.

Table No. 4
Federal Land Bank
Loan Experience in Gilliam County,
Organization to December 31, 1939

Fed. Land Bank	Loans Outstanding Type	No.	Amount	Loans Acquired* No.	Amount	Loans Paid Off No.	Amount	Loans Closed** No.	Amount	Total Acres	Cultiv. Acres
			100 dollars		100 dollars		100 dollars		100 dollars		
1917-23	Dairy 3					1	37	1	37	280	220
	Wheat 5	54	3,172	45	2,087	25	990	124	6,249	62,629	40,892
	Range Livestock 6	10	542	4	445	1	100	15	1,087	21,907	3,044
	Mixed*** 7	5	382	5	167	2	120	12	669	7,893	4,305
	General 8	11	406	5	161	1	16	17	583	6,173	1,979
	Total	80	4,502	59	2,860	30	1,263	169	8,625	98,882	50,440
1924-32	Wheat 5	23	1,336	8	421	2	185	33	1,942	20,674	14,615
	Range Livestock 6	2	155	2	105	1	75	5	335	11,339	1,862
	Mixed*** 7	2	200					2	200	2,590	1,085
	General 8			1	21			1	21	356	280
	Total	27	1,691	11	547	3	260	41	2,498	34,959	17,842
1933-39	Wheat 5	31	1,884			2	66	33	1,950	40,340	27,714
	Range Livestock 6	5	170					5	170	13,236	990
	Mixed*** 7	2	310					2	310	6,697	3,004
	General 8	1	13					1	13	160	34
	Total	39	2,377			2	66	41	2,443	60,433	31,742
Land Bank Commissioner											
1933-39	Dairy 3	1	30					1	30	225	54
	Wheat 5	30	1,146			4	133	43	1,279	39,584	27,347
	Range Livestock 6	4	116					4	116	12,421	1,497
	Mixed*** 7	2	60			1	50	3	110	7,225	3,161
	General 8	4	94			1	20	5	114	1,150	379
	Total	41	1,446			6	203	56	1,649	60,605	32,438

* Loans acquired by foreclosure **Total loans at end of period ***Wheat & livestock

Table No. 5
Average Cultivated Acreage and Average Size of Loans Per Farm for Farms with Federal Land Bank and Land Bank Commissioner Loans for the period 1917-1939

	Ave. Cultivated Acreage Per Farm	Ave. Size of Loan Per Farm
1917-23	292	$5,103
1924-32	435	6,092
1933-39	774	5,961
1933-39 Land Bank Com. Loans	577	2,944

Table No. 4
Federal Land Bank
Loan Experience in Gallatin County,
Organization to December 31, 1929

Federal Land Bank	Loans Outstanding Type	No.	Amount 100 dollars	Loans Acquired No.	Amount 100 dollars	Loans Paid Off No.	Amount 100 dollars	Loans Delinquent No.	Amount 100 dollars	Total Acres	Outstanding Acres
1917-23	Dairy	3				1	37	1	37	280	230
	Wheat & Range	3	34	3,172	45	2,007	25	090	124	6,246	40,072
	Livestock	6	10	542	4	445	1	100	15	1,027	21,907	3,044
	Miscellaneous	7	5	320	5	167	2	130	12	609	7,292	4,305
	General	8	11	4,000	5	161	1	16	17	583	6,173	1,072
	Total		80	4,202	54	2,300	30	1,293	169	5,105	38,862	50,440
1924-32	Dairy & Range	5	23	1,335	8	421	2	185	33	1,247	20,674	14,615
	Livestock	6	2	155	2	105	1	75	5	235	11,339	1,862
	Miscellaneous	7	2	200					2	200	2,590	1,085
	General	8			1	21			1	21	355	280
	Total		27	1,691	11	547	3	260	41	1,703	34,859	17,842
1933-39	Wheat & Range	5	31	1,[illegible]			5	65	35	1,900	40,340	27,724
	Livestock	6	5	170					5	170	13,236	760
	Miscellaneous	7	2	210					2	210	6,607	3,024
	General	8	1	13					1	13	380	14
	Total		39	2,[illegible]			5	65	43	2,443	60,423	31,362
Joint Stock Land Bank												
1923-39	Dairy	1	1	30					1	30	225	54
	Wheat & Range	5	30	1,146			4	123	43	1,279	39,584	27,347
	Livestock	6	4	116					4	116	12,421	1,407
	Miscellaneous	7	2	40			1	50	3	120	7,294	3,161
	General	8	4	94			1	20	5	114	1,180	370
	Total		41	1,446			6	203	56	1,659	60,685	32,429

Loans acquired by foreclosure -Total loans at end of period - Loans 6 Livestock

Table No. 5
Average Cultivated Acreage and Average Size of Loans For Farm for Farms with Federal Land Bank and Joint Stock Land Bank Mortgage Loans for the period 1917-1929

	Ave. Cultivated Acreage For Farm	Ave. Size of Loan For Farm
1917-23	272	45,103
1924-32	425	6,062
1933-39	774	5,061
1923-39 Land Bank Con. Loans	277	2,944

As reason for the relatively large number of repossessions during the period from 1917-32, the Federal Land Bank lists low prices for agricultural products and overappraisement of the land.

There are 12 Production Credit Association loans in the county, amounting to a total of $91,581. Of this number, six are livestock loans which average $7,237 each, three wheat loans averaging $7,793, and three combination wheat and livestock loans averaging $8,290 each.

The Farm Security Administration has made 13 loans amounting to $26,942 in Gilliam county, of which $7,022 has been repayed. The majority of these loans have been made to the smaller livestock operators located on the irrigated creek bottoms, as the operators of the larger units do not meet the qualifications for this type of financing. The Farm Security Administration estimates that a total of 20 loans in the county will take care of the financing needs of the lower income farm groups.

Problems and Recommendations

1. The committee considers that the loan value of lands in the county allowed by credit agencies is generally too low at the present time compared with the actual value of the land. This situation indicates an inconsistent policy on the part of the loaning agencies, since in the past loan values of farm lands were too high.

It is recommended by the committee that credit agencies owning farms in the county sell these farms at actual value instead of at values based upon the investment the agency has in the land, which often makes the price too high. It is felt that the agencies should take whatever loss necessary rather than pass it on to the purchaser.

2. The committee feels that too long a period elapses between the time a farmer applies for a loan and the time that the loan is completed and the money made available.

It is recommended that some means be employed by credit agencies to allow them to make loans more rapidly.

3. At the present time farms owned or heavily encumbered by credit agencies are rapidly running down because no effort is made by the farm operator to control erosion, maintain buildings and fences, or eradicate perennial weeds.

It is suggested that farm credit organizations having considerable equity in or owning farms in the county provide a fund for the maintenance of such places.

4. It is recommended that credit agencies follow the land use committee's recommendations on cultural practices, weed control, and retirement of lands not suitable for cultivation in making loans on farms in the county.

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Taxation

Explanation of Present Situation

The committee on taxation for the economic conference of 1938 made detailed recommendations on tax problems in Gilliam county, many of which have been carried out. As was recommended by the committee, assessments are now made on a measured acre basis on the farms for which Agricultural Adjustment Administration figures are available and inequalities in property valuations have been adjusted so that farms compare with similar adjoining farms.

Problems and Recommendations

Present tax problems considered by the land use committee are listed as follows:

1. A considerable acreage of crested wheatgrass has been seeded in Gilliam county during the past few years which will be returned to non-cropland. The grass is comparable with native range and in order to tax this land at its true value the assessed valuation on such land should be reduced.

It is recommended by this committee that if and when the permanent grass seeded on the land ceases to be called "diversion" under the program of the AAA the tax structure be revised to the extent that the assessment of such land will be comparable with native range. It is felt, however, that in most instances the permanent grass seedings have more value than do the average native ranges.

2. Inequalities in assessments still exist on the farm lands in the county with regard to soil types and slope.

It is recommended that further information be secured through soil surveys and AAA slope maps for use in adjusting assessments on cultivated land. On range lands it is recommended that as range surveys are completed a classification be made of such lands based on their carrying capacity. Such information would allow inequalities in valuation of range lands for assessment purposes to be adjusted.

Tenancy

Explanation of the Present Situation

A large percentage of Gilliam county farms are non-operator owned. This situation is probably caused by farm owners retiring and leasing their farms, the large investment per farm, and losses to mortgage holders because of excessive valuation. Statistical data on tenancy are shown in Table No. 6.

Table No. 6
Ownership of Tillable Land, Gilliam County*

	Percent			Percent
Owner operated	57	Absentee landlords		31.5
Tenant operated	43	Individuals	21.0	
		Corporation	10.5	
		Resident landlords		11.5

*1940 AAA Listing Sheets

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		Resident landlords	46.5

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Recommendations

In general owner operation is preferred in the county and should be encouraged.

In order to develop and maintain a well rounded land use program it is necessary that absentee landlords be informed of the agricultural problems of the county and the recommendations that have been made by the land use committee for solving these problems. For the past several years the county agent has prepared a letter at least once every two months for absentee landlords, giving them information on developments which affect agriculture in the county. This practice should be continued in order to obtain the support of absentee landlords in carrying out land use recommendations.

Long term leases are recommended and all landlords in the county are encouraged to provide their tenants with such leases in order that they may plan their farming operations far enough in advance to consider all land use recommendations which have been made.

AREA CLASSIFICATION AND RECOMMENDATIONS

Area classification in Gilliam county has been based upon the outline, "Oregon Mapping Procedure for Land Use Adjustments", which was prepared by the Land Grant College-Bureau of Agricultural Economics committee, December 5, 1939, and revised February 23, 1940. This outline is a modification of work outline No. 1, issued by the Washington office of the BAE and provides for a more detailed land classification. The classification divides agricultural lands from forest areas and irrigated farm land from non-irrigated farm lands and grazing lands. Figure No. 1, "The Land Use Map", shows the land use classification made for Gilliam county by the committee.

I. Areas Needing Minor Adjustments

Areas now in agricultural use (farm or grazing) in which only minor adjustments, if any, are needed.

A. Subarea No. 1. Solid black. Irrigated lands in the Lonerock and Condon communities.

1. Description

As is indicated above, this area is entirely irrigated and consists of approximately 500 acres.

The present use of the area is principally for the production of hay crops, mostly alfalfa. The location is along Thirty Mile creek, Rock creek, and the John Day river.

The average acreage of irrigated land per farm in the area is 55.

2. Problems and Recommendations

Minor problems of the area include:

Recommendations

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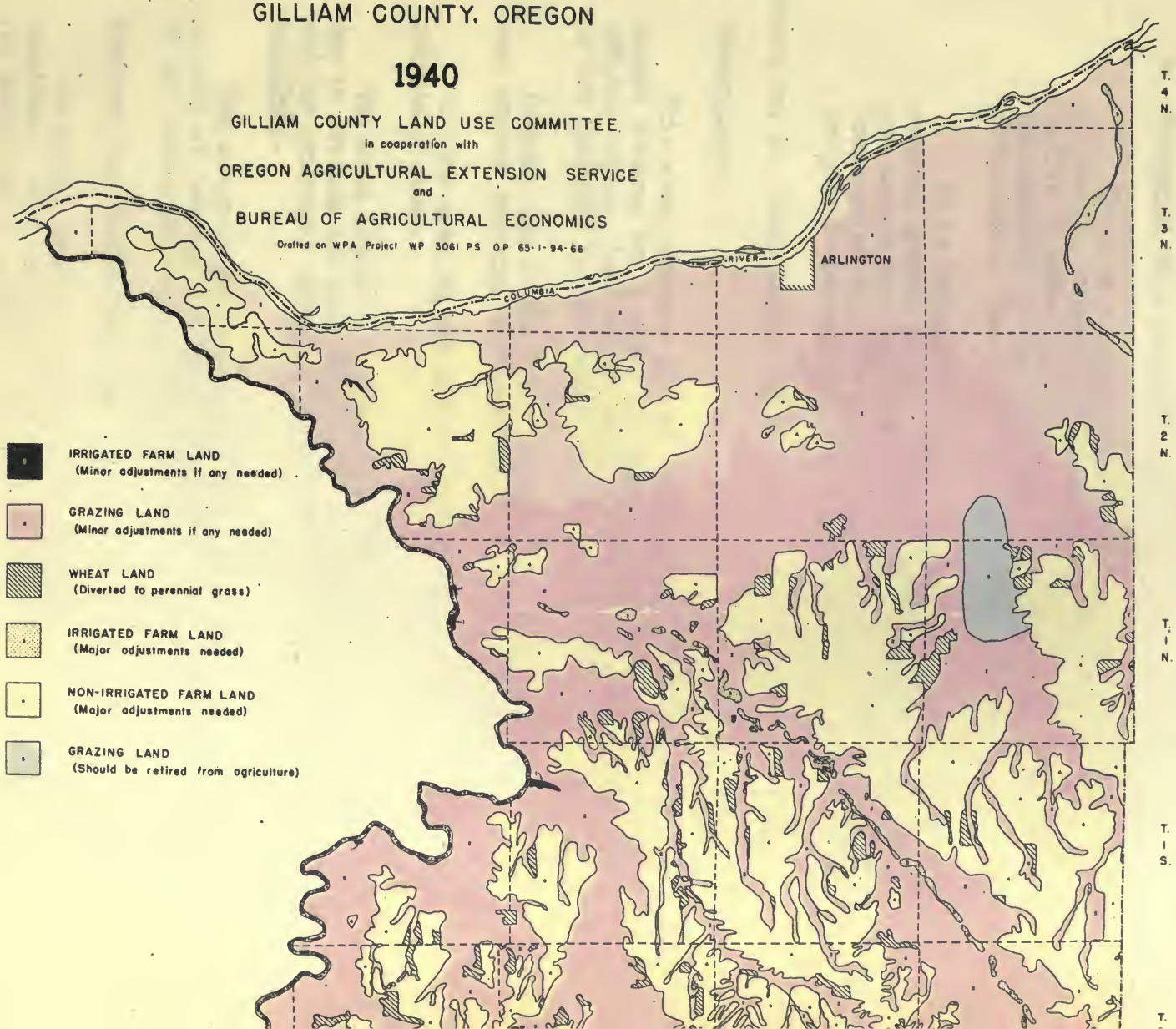
LAND USE ADJUSTMENTS

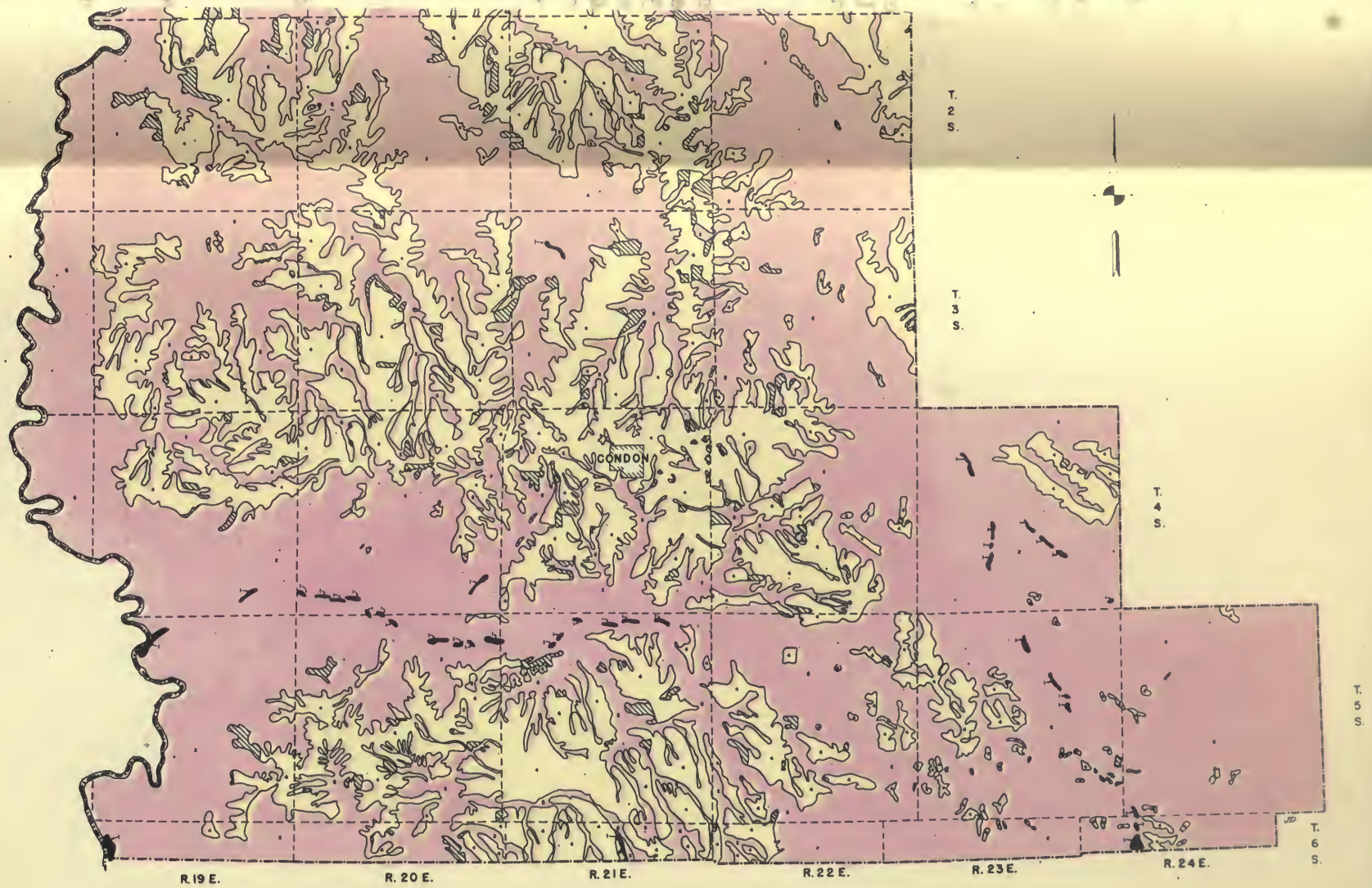
GILLIAM COUNTY, OREGON

1940

GILLIAM COUNTY LAND USE COMMITTEE
in cooperation with
OREGON AGRICULTURAL EXTENSION SERVICE
and
BUREAU OF AGRICULTURAL ECONOMICS

Drafted on W.P.A. Project WP 3061 PS OP 65-1-94-66





COLOR REPRODUCTION BY BUREAU OF AGRICULTURAL ECONOMICS.

a. Increasing Production

There is a general shortage of feed produced on these irrigated lands. This is particularly true in the Lonerock community. Production can be increased through the use of better adapted and higher producing varieties of alfalfa. It is recommended that all available land be seeded to adapted varieties of alfalfa. Early season use of available irrigation water in order to better utilize the small amount which is available is also recommended.

b. Perennial Weed Control

There is a small infestation of perennial weeds consisting of Russian knapweed, morning-glory, and white top. The possibility of spreading weeds on these irrigated lands is very great, particularly in the Lonerock community where hay is brought in from outside the community for feeding purposes.

It is recommended that where perennial noxious weeds exist control operations with chemicals be followed. Sodium chlorate and carbon bisulphide are used commonly at the present time. Cooperation with the county court in the county-wide weed control program is recommended to farmers owning land in this area.

B. Subarea No. 2. Range land. Solid pink.

1. Description

This area includes all of the non-tillable land in the county except Subarea No. 5 which is colored blue. The area includes 499,640 acres. Land which has been seeded to crested wheatgrass is not included in this subarea.

Present use of the area consists of spring and fall grazing with some winter grazing, particularly in the northern end of the county.

Of this area 80,966 acres are publicly owned and 418,674 acres privately owned.

The area supports a bunchgrass cover, although in some locations due to overuse and past drouths the bunchgrass cover has been depleted and the principal cover is annual grasses such as cheatgrass, (Bromus tectorum).

The range is all rough land unsuited to cultivation. It consists largely of canyons and steep rocky lands that are intermixed over most of the county with the cultivated areas.

2. Problems and Recommendations

No change from the present grazing use is recommended by the committee. With minor adjustments the area is thought to be suited for continuation in its present use.

a. Increasing Production

There is a general shortage of feed produced on these irrigated lands. This is particularly true in the Lonerock community. Production can be increased through the use of better adapted and higher producing varieties of alfalfa. It is recommended that all available land be seeded to adapted varieties of alfalfa. Early season use of available irrigation water in order to better utilize the small amount which is available is also recommended.

b. Perennial Weed Control

There is a small infestation of perennial weeds consisting of Russian knapweed, morning-glory, and whitetop. The possibility of spreading weeds on these irrigated lands is very great, particularly in the Lonerock community where hay is brought in from outside the community for feeding purposes.

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Present use of the area consists of spring and fall grazing with some winter grazing, particularly in the northern end of the county.

Of this area 80,966 acres are publicly owned and 418,074 acres privately owned.

The area supports a sunshrub cover, although in some locations due to overuse and past drouths the sunshrub cover has been depleted and the principal cover is annual grasses such as cheatgrass, (Bromus tectorum).

The range is all rough land unsuited to cultivation. It consists largely of canyons and steep rocky lands that are interwoven over most of the county with the cultivated areas.

2. Problems and Recommendations

No change from the present grazing use is recommended by the committee. With minor adjustments the area is thought to be suited for continuation in its present use.

a. Overgrazing

Some of the area has been seriously overgrazed in the past to such an extent that perennial grasses in some cases have been eliminated and as a result erosion has become serious.

To overcome this situation it is recommended that deferred grazing be adopted on all of the range lands in the county so that 25 percent of the area each year is allowed to reseed. It is also recommended that each operator reseed by artificial means small areas where this practice is feasible. In the past, artificial reseeding has not been entirely successful, and for this reason it is recommended that research be continued in order to develop economic and favorable means of seeding and in order that the best adapted grasses may be determined.

b. Lack of Stock Water

Water development is needed on many ranges particularly in the northern part of the county. Such development would allow better range management practices to be adopted and would encourage better utilization of the range.

It is recommended in these areas lacking water developments that all springs and seeps be developed to obtain a maximum flow of water. Also in some instances stock ponds are feasible. On certain of the ranches, especially in the north end of the county, wells must be drilled to provide adequate stock water.

c. Range Fences

In order to bring about proper control of range livestock, additional boundary and cross fences are necessary. It is therefore recommended that the program of range fencing be continued.

d. Rodent Control

Ground squirrels are present in the entire county, but in the Lonerock community are very prevalent. These pests destroy valuable forage every year. It is recommended that each operator carry on an extensive control campaign.

e. Predatory Animal Control

The control of coyotes on sheep ranges is a benefit in this county insofar as proper range management is concerned, due to the fact that it often eliminates the necessity of trailing sheep, particularly during lambing, to corrals for protection. It is recommended that continued cooperation for coyote control be maintained between federal, state, and county agencies.

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c. Barge Fences

In order to bring about proper control of range livestock, additional boundary and cross fences are necessary. It is therefore recommended that the program of range fencing be continued.

d. Rodent Control

Crowed squirrels are present in the entire county, but in the Lonrock community are very prevalent. These pests destroy valuable forage every year. It is recommended that each operator carry on an extensive control campaign.

e. Predatory Animal Control

The control of coyotes on sheep ranges is a benefit in this county insofar as proper range management is concerned, due to the fact that it often eliminates the necessity of herding sheep, particularly during lambing, to provide for protection. It is recommended that continued cooperation for coyote control be maintained between Federal, state, and county agencies.

C. Subarea No. 2-a. Black hatchure. Wheatland seeded to grass.

1. Description

This area consists of 20,000 acres of land which have been retired from cultivation and seeded to crested wheatgrass. Much of the area was retired because of steepness of slope, isolation, erosion, or soil types that made it unsuitable for cultivation. At the present time it is used for grazing.

2. Problems and Recommendations

Most of the area is in its best use at the present time and has no particular problems. Proper range management is recommended in order to maintain the stands of grass for proper utilization.

Recommendations for the range areas in Subarea No. 2 also apply to this subarea.

II. Areas Needing Major Adjustments

Areas now in agricultural use in which major adjustments are needed.

A. Subarea No. 3. Stippled yellow. Irrigated lands in the Olex community.

1. Description

These irrigated lands are located on Rock creek and Willow creek, and consist of approximately 1,900 acres.

Livestock production is the main enterprise of these irrigated farms. The crops that are produced are principally alfalfa and a small acreage of corn and grain. The irrigated tracts are in most cases connected with range units. The average acreage of irrigated land per farm for the area is 55 acres.

2. Problems and Recommendations

Weed control is the principal problem in this area. There are heavy infestations of Russian knapweed, white top, and morning-glory. Due to this infestation farms have been entirely abandoned in a few instances on Willow creek. All irrigated lands on Willow creek and 90 percent of those on Rock creek are in such a position that farmers must maintain constant vigilance to prevent noxious weed spread.

It is recommended that small patches of weeds on these irrigated lands be controlled by the use of chemicals. The larger areas should be controlled by continuous cultivation either alone or following a smother crop.

It is recommended that every farmer control the weeds on his own farm, both to protect himself and to prevent spreading of these noxious weeds to other farms. Cooperation with the county court is urged in maintaining the county-wide weed control district.

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B. Subarea No. 4. Solid yellow. Non-irrigated farm land.

1. Description

Total acreage of this area is 242,600 acres.

Subarea No. 4 is scattered through all sections of the county, mainly where the soil is deeper and where there are less rocks on the ridges between the canyons. The location differs slightly in the Lonerock community where the non-irrigated cropland is located in small isolated tracts on slopes which are not too steep for practical farming.

Wheat raising, supplemented by livestock production, is the principal type of farming followed in the area.

Average size of farm in the area is 2,267 acres, and it is estimated that the average tillable area per farm is in excess of 1,200 acres.4/ This average acreage per farm is the highest of any county in the state.

On the basis of present prices for wheat and the present cost of production, the committee feels that approximately 1,200 acres of cultivated land per farm is needed by the average dry-land operator in Gilliam county to maintain the present standard of living.

The average wheat yield for the period 1930-40 for Gilliam county is 12.3 bushels per acre, based on AAA records.5/ Yields vary in different areas and on different farms depending on the management, soils, and precipitation.

2. Problems and Recommendations

a. Erosion

The most important land use problem in the county is erosion since it affects the largest area and the most important agricultural districts. It consists of two types - wind and water erosion. The loss from water erosion is the more serious. On the lighter soils of the northern third of the county most of the erosion has been caused by winds. Water erosion is of major importance on the heavier, more shallow soils of the southern two-thirds.

Considerable amounts of top soil have been lost during the past 50 years that the land has been farmed in the county. Tables 7 and 8 give information on soil losses from erosion for Gilliam county based on tests and surveys made by the Soil Conservation Service.

4/ Report and Recommendations of Gilliam County Economic Outlook Conference, 1938.

5/ Adjusted figures from Gilliam County Agricultural Conservation Association.

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Table No. 7
Summary of Soil Loss Estimates
Taken by Rill Measurements
Soil Conservation Service
Gilliam County
1936 - 1940

Effect of Tillage on Soil Loss from Water Erosion

Soil No. I ..... Upland soils with permeable subsoils over 30 inches to bedrock.
Soil No. II ..... Upland soils with heavy subsoils 27 to 48 inches to bedrock.
Soil No. III ..... Upland soils, less than 30 inches to bedrock.

	NOT TRASHY SUMMER FALLOW*:			TRASHY SUMMER FALLOW		
	Tests Made	Average % Slope	Average Loss in T. per Acre	Tests Made	Average % Slope	Average Loss in T. per Acre
Soil No. I	6	14	44.19	11	14½	19.85
Soil No. II	9	15	50.01	8	14	16.26
Soil No. III	2	20	125.00	3	9	35.50

	CULTIVATED DOWN-HILL			CONTOUR CULTIVATED**		
	Tests Made	Average % Slope	Average Loss in T. per Acre	Tests Made	Average % Slope	Average Loss in T. per Acre
Soil No. I	12	13	37.16	5	16½	7.52
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Soil No. III	3	16	88.83	2	10	45.00

	NOT TRASHY SUMMER FALLOW AND DOWNHILL CULTIVATION			TRASHY SUMMER FALLOW AND DOWNHILL CULTIVATION		
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	Tests Made	Average % Slope	Average Loss in T. per Acre
Soil No. I	5	16½	7.52
Soil No. II	8	14	16.26
Soil No. III	2	10	45.00

*Cultivation was also downhill as well as not being trashy which accounts for the fact that this part of the table is the same as the part, "Not Trashy Summer Fallow and Downhill Cultivation."

**The "Contour Cultivated" table is the same as the "Trashy Summer Fallow and Contour Cultivation" table because the tests made for contour cultivation were also trashy summer-fallowed.

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Table No. 8
Extent of Erosion on Wheatlands of Gilliam County
1936 6/
(Based on a study of 71 farms located in Umatilla, Sherman and Gilliam counties made by Clarence Waldo and Howard Magness of the Soil Conservation Service, U. S. Department of Agric.)

Cropland where less than 25% of surface soil removed.	Cropland where 25 to 75% of surface soil removed.	Cropland where over 75% of surface soil removed.	Cropland where all of surface soil removed and subsoil now being eroded.
Percent	Percent	Percent	Percent
30.9	58.7	10.4	None

The committee feels that increasing attention must be given to erosion control methods in the future if at least 50 percent of the present tillable land is to be profitably used for wheat production over a long period of time. It is recommended that practices be carried out each year to minimize the losses from erosion. Practices which appear to be most practical at the present time are trashy summer fallow, which involves leaving the straw and stubble near the surface of the soil during the summer-fallow operation; contour tillage, grass rotations, and controlled grazing on stubble lands.

It is recommended that trashy summer fallow be used over the entire area as a method of preventing erosion. Plows with the moldboards removed, modified moldboards, Lister shares, and in some cases subsurface tillers are used at a shallow depth to produce trashy summer fallow. The one-way disc plow is not recommended for producing trashy summer fallow except where heavy stubble exists on the heavier soils.

The use of the trashy summer fallow practice to prevent erosion has increased considerably during the past four years. Table 9 shows the acreage in Gilliam county for the years 1937-40.

Table No. 9
4 Year Summary of Trashy Summer Fallow Acreage
Gilliam County

Year	Number of Farms	Acreage
1937	63	23,400
1938	69	25,500
1939	151	55,580
1940	133	42,252*

*The decrease in trashy summer fallow in 1940 from 1939 can be accounted for by the fact that there was a shortage of stubble from the 1939 crop and good moisture conditions in 1940.

6/ Agricultural Experiment Station Bulletin 373, "Land Use and Production Costs on Dry-Land Wheat Farms, Columbia Basin, Oregon." 1940. A. S. Burrier and W. W. Gorton.

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Trashy summer fallow is a relatively new practice on wheat farms in the county. Further information on its use is needed. It is generally believed that it is more expensive than clean summer fallow and its effect on wheat yields over a period of years is not known. To secure the information on the practice thorough research is recommended to be continued. It is possible that better practices which are more practical for erosion control than trashy summer fallow may be developed.

Contour cultivation is recommended for all but the more level lands in the county.7/ On the steeper land farming crossways to the general slope has proved a practical means of preventing soil loss from water erosion. The seeding of the steeper lands and points permanently to grass has better enabled the farmer to carry out this practice, and for this reason contour cultivation has increased with the seeding of crested wheatgrass.

Rotation grass seedings are recommended to prevent erosion by building up the organic content of the soil, which will improve moisture absorption and tend to prevent runoff after the grass seedings are broken up for wheat production. Such grass rotations will also tend to increase wheat yields and will aid in maintaining a permanent and prosperous agriculture over a long period.

Studies of the economic effect of retiring wheatland to grass in the Columbia Basin indicate that land which yields more than eight to ten bushels per acre will probably return more in actual cash to the farm business if left in wheat. The seeding out of such land can be justified only from the standpoint of soil conservation.8/

It is the recommendation of the committee that 31,000 acres of land now being used for wheat production be seeded to perennial grasses for rotation grass seedings, this acreage to be principally made up of the steeper farm lands which are now subject to water erosion.

It is the practice in Gilliam county to use the stubble fields after harvest for grazing purposes. In some instances, unless grazing is controlled the cover is utilized to such an extent that erosion occurs. This is particularly true during dry years when the straw is very palatable to livestock.

7/ Contour cultivation as referred to by the committee is different than that practiced in most sections of the U. S. in that farm operations are not done strictly on the contour but crossways to the general slope.

8/ Estimate based upon economic analyses of representative farms to show the effect of wheatland retirement on farm income. See mimeographed report, "The Effect of Soil Conservation Practices on Farm Income in the Dry-land Wheat Region of Oregon," by H. L. Thomas, Soil Conservation Service.

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It is the recommendation of the committee that grazing be limited on stubble fields so that overuse will not occur.

In the Condon community there are numerous scab draws running through the cropland. These draws are the natural waterways and where water erosion is taking place there is much loss of soil.

It is recommended that intermittent earth and rock dams be placed in these draws to hold the soil and to stop soil washing. The dams will hold moisture and accumulate soil. The edges may also be graded down so that they may be farmed across, which facilitates contour farming.

Information on slopes of cultivated land in Gilliam county, which was taken from topographic surveys will be shown in Figure 2, if received in time for this report.

The committee feels that soils susceptible to erosion that cannot be controlled by tillage methods and grass rotations, because of steepness of slope or soil type, should be retired to grass permanently. Such areas are discussed further under Retirement of Land Not Suited to Cultivation. (Section c. below)

b. Weed Control

The infestation of morning-glory on the non-irrigated farm land is a threat to the agriculture of the county. Although this weed is found on approximately 40 percent of the farms, with the exception of only a few farms the area of morning-glory is not large enough on any one farm at the present time to interfere with crop production. To prevent further spread, weeds must be eliminated when the patches are small, as control is expensive and difficult when the area is large. The committee feels that precautions to prevent spreading are necessary.

It is recommended that the farmers cooperate with the county court on the weed control problem. The county-wide weed control district should be maintained. The same recommendations made for irrigated farms generally apply to the non-irrigated areas. Chemical control is recommended for small patches of weeds and good results have been obtained with sodium chlorate and carbon bisulphide.

Properly timed cultivations or a smother crop followed by cultivation is recommended for the larger areas. In controlling weeds by this method measures should be taken to prevent wind erosion. The seeding of larger areas, where control practices are not practical, to crested wheatgrass will prevent spreading and also bring some returns from the land.

c. Retirement of Land Not Suited to Cultivation

The major change recommended by the committee in utilization of present cultivated land is that approximately 23 percent, or 61,000 acres, of the present 265,000 acres considered as

It is the recommendation of the committee that grazing be limited on stubble fields so that overuse will not occur.

In the Condon community there are numerous scab draws running through the cropland. These draws are the natural waterways and where water erosion is taking place there is much loss of soil.

It is recommended that intermittent earth and rock dams be placed in these draws to hold the soil and to stop soil washing. The dams will hold moisture and accumulate soil. The edges may also be graded down so that they may be farmed across, which facilitates contour farming.

Information on slopes of cultivated land in Gilliam county, which was taken from topographic surveys will be shown in Figure 2, if received in time for this report.

The committee feels that soils susceptible to erosion that cannot be controlled by tillage methods and grass rotations, because of steepness of slope or soil type, should be retired to grass permanently. Such areas are discussed further under Retirement of Land Not Suited to Cultivation. (Section c. below)

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The major change recommended by the committee in utilization of present cultivated land is that approximately 23 percent, or 61,000 acres, of the present 265,000 acres considered as

cultivated land be seeded to perennial grass. 30,000 acres of this amount is recommended for permanent seedings not to be plowed again unless to be reseeded to grass. As mentioned previously, 31,000 acres are to be included in grass-wheat rotations. At the present time 30,500 acres of the 61,000 acres are in crested wheatgrass, 20,000 acres permanently retired wheatlands, and 10,500 acres in grass-wheat rotations.

It is recommended that land coming under the following classifications be included in the permanent grass acreage of the county:

(1) Land on which the average return from wheat is less than the cost of production because of location, high cost of farming, or low yields. Table 10 shows cost of production for wheat farms in Gilliam county.

Table No. 10
Average Cost of Producing One Acre of Wheat in Gilliam County*

1.	Plowing	$ .75	6.	Sacks and Twine	$ .60
2.	Cultivation	.50	7.	Hauling to Market	.50
3.	Seeding	.35	8.	Insurance	.08
4.	Seed	.90	9.	Interest, 5% on $20 for 2 years	2.00
5.	Harvesting	1.75	10.	Taxes, average 35¢ for 2 years	.70
					$ 8.13

*Report and Recommendations of Gilliam County Economic Outlook Conference, 1938.

Using $8.13 as the average cost per acre of producing wheat in Gilliam county and taking into consideration the average AAA payment per acre of $1.74 9/ at the average price of 70 cents 10/ per bushel for wheat, the average Gilliam county wheat farmer would have to obtain a yield in excess of 9 bushels of wheat per acre in order to secure a return over cost of production.

Based upon production records the average wheat yield for the period 1930 to 1940 from an average yearly seeded acreage of 115,880 acres has been set at 12.3 bushels per acre. Of the 104,877 acres seeded to wheat for grain in the county in 1940, the committee estimates that approximately 9,500 acres, or 9%, 11/ is producing less than 9 bushels per acre as an average yearly yield and recommends that this acreage be seeded permanently to grass. It is the opinion of the committee that this low producing

9/ The average AAA payment received per crop acre in Gilliam county in 1939 was 87¢ as calculated by the AAA. For the two years required to produce wheat the amount would be $1.74 per acre.

10/ Average farm price of wheat in Oregon for the first ten months of 1940.

11/ AAA production records by years fail to show the acreage producing below the cost of production since they represent work sheet farm averages and not individual fields or parts of fields.

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				$	6.13

*Report and Recommendations of Gilliam County Economic Outlook Conference, 1938.

Using $6.13 as the average cost per acre of producing wheat in Gilliam county and taking into consideration the average AAA payment per acre of $1.74 2/ at the average price of 90 cents 10/ per bushel for wheat, the average Gilliam county wheat farmer would have to obtain a yield in excess of 9 bushels of wheat per acre in order to secure a return over cost of production.

Based upon production records the average wheat yield for the period 1930 to 1940 from an average yearly seeded acreage of 115,880 acres has been set at 12.5 bushels per acre. Of the 104,277 acres seeded to wheat the grain in the county in 1940, the committee estimates that approximately 9,500 acres, or 9%, 11/ is producing less than 9 bushels per acre as an average yearly yield and recommends that this acreage be seeded permanently to grass. It is the opinion of the committee that this low producing

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land is located as small areas on almost every farm in the county. The 20,000 acres of crested wheatgrass that have already been permanently retired from wheat production include a large proportion of low yielding wheatland.

(2) Land on which erosion cannot be controlled if cultivation is practiced. Such land would include light soils subject to severe wind erosion when under cultivation and the slopes on which water erosion due to soil type, steepness of slope, or previous misuse is occurring and which cannot be controlled by cultural practices such as contour farming and trashy summer fallow. It is impossible for the committee to determine the exact acreage of lands which should come under this classification due to the lack of detailed information on soil types in the county and the extent of erosion on the steeper slopes.

(3) Land infested with morning-glory or other perennial weeds where the affected area is so large that chemicals or cultivation methods of eradication are not feasible.

(4) Land which is now seeded to rye or wheat for pasture. The committee believes that crested wheat will produce at least as much pasture as annual grains and will eliminate the necessity of expensive plowing and seeding.

At the present time 20,000 acres of land coming under the above classifications have been seeded to crested wheat. Table 11 gives a summary of the increase in the crested wheat acreage in the county by years. Crested wheatgrass has proved to be the most desirable perennial grass adapted to Gilliam county conditions. However, in order to investigate any possibility of a more palatable, faster growing, and easier established grass it is recommended that additional research be continued.

Table No. 11
Expansion of Crested Wheat Acreage
Gilliam County, 1931-40

Year	Growers	Acreage	Year	Growers	Acreage
1931	2	2	1936	91	10,450
1932	3	3	1937	112	14,950
1933	3	6	1938	163	25,800
1934	15	130	1939	183	30,200
1935	21	152	1940	195	30,500

The exact location of lands which the committee feels should be retired permanently to grass is not possible until a complete soil survey of the county is made. Soils information combined with information on slopes as shown in Figure 2 will allow more accurate location of lands which should be retired.

The committee recommends that a complete soil survey of Gilliam county be undertaken as soon as possible.

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The committee recommends that a complete soil survey of Gilliam county be undertaken as soon as possible.

d. Feed Development in the Lonerock Community

As explained under Subarea 1 the Lonerock community has very often suffered during past years from lack of feed. Increase in the feed acreage on irrigated land is recommended by the committee.

The committee feels that the non-irrigated cultivated land of the community would produce more hay and feed if conscientious summer fallow operations were adopted. At the present time annual weeds are allowed to grow, which reduces the moisture available for crop production.

e. Use of Wheat for Livestock Feed

Due to the present uncertainty with respect to the world wheat situation the committee recommends that livestock numbers on farms be increased as much as their feed supply will permit. It is considered desirable to feed all low priced and poor quality wheat in increasing amounts. Wheat of this type can be profitably marketed in this manner. It will also provide an insurance to the wheat grower against wheat failures and low prices. The use of wheat for livestock feed will also enable Gilliam county livestock operators to do a better job of fattening their animals for market.

III. Blue Area - Range area to be retired from agricultural use.

Subarea No. 5. Solid blue.

1. Description

The area is located in the Olex community in the Eightmile canyon area. The soil is sandy and subject to wind erosion. The area is 4,000 acres in size and is adjacent to approximately 10,000 acres of cropland. It is owned by three operators at the present time.

2. Problems and Recommendations

This area of range lands was seriously eroded by wind in 1935, 1936, and 1937. At that time it was a menace to the adjacent cropland. The seriousness of wind erosion depends upon the amount of moisture that is received each year. Since 1937 the area has not blown seriously because of a light cover of annual weeds and grass that became established.

It is recommended that in order to prevent the area from blowing during dry periods and to protect the adjoining land, that the area be purchased by some federal agency. It is further recommended that the area be seeded to perennial grass or other vegetation and if necessary windbreaks or other erosion control measures be taken to stop the wind erosion. Grazing of the area should not be permitted until grass stands are established.

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A summary of acreages for the different land use areas is shown in Table 12.

Table No. 12
Summary of Land Use Areas

	Areas designated by Land Use Committee			
	Brown	Yellow	Blue	Total
Total acreage	520,140	244,500	4,000	768,640
Percent of land in operating units	85.5%	100%	100%	89.5%
Average size of farm				2,267
Acreage cultivated	500	241,446		241,946
Acreage idle		3,054		3,054
Acreage in grazing	519,640*		4,000	523,640

*Includes 20,000 acres in permanent crested wheatgrass seedings.

SUMMARY

The recommendations for adjustment of major agricultural problems of Gilliam county are summarized by the committee as follows:

1. Control of Erosion

In order to best use the land over a long time period so that it may be preserved in a productive condition, practices to prevent losses from erosion must be generally adopted by all farmers in the county. At the present time the cultural practices of incorporating straw and stubble into the surface of the soil and of farming the steeper slopes as much as possible on the contour appear to be the most suitable. Long time grass rotations with wheat and summer fallow will check erosion by building up the moisture absorbing ability of the soil.

2. Weed Control

Control of noxious weeds which are now well started in the county is recognized as of importance. Unless control measures are taken returns to the farm will be greatly reduced and particularly in the case of irrigated land, may easily prevent profitable farming. The weed control program of the county court is available to all farmers to aid them in their control efforts.

3. Range Improvement

While livestock production on most farms in the county is secondary to wheat production it is of such importance that if it were eliminated 35 percent of the agricultural income of the county would be lost. The preservation and improvement of the range land in the county is necessary if livestock production is to be successfully maintained. The building up of range lands now seriously depleted can be done by deferred grazing

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Average size of farm				2,247
Acreage cultivated	500	241,446		241,946
Acreage idle		3,054		3,054
Acreage in grazing	519,640*		4,000	523,640

*Includes 20,000 acres in permanent oriented wheatgrass meadows.

SUMMARY

The recommendations for adjustment of major agricultural problems of Hillsdale county are summarized by the committee as follows:

1. Control of Erosion

In order to meet use the land over a long time period so that it may be preserved in a productive condition, practices to prevent losses from erosion must be generally adopted by all farmers in the county. At the present time the cultural practices of incorporating straw and stubble into the surface of the soil and of farming the steeper slope as much as possible on the contour appear to be the most suitable. Long time crop rotations with wheat and summer fallow will check erosion by building up the moisture absorbing ability of the soil.

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to allow natural reseeding, by artificial reseeding, and by preventing overgrazing. Ranges can be better utilized by developing stock watering places and by adopting other desirable range management practices.

4. Return of Lands Not Suited to Cultivation to Grass

On the majority of farms in the county there are now being farmed areas which for reasons of poor soil, steepness, inaccessibility, or erosion are not making returns over the cost of production. These lands can be reseeded to varieties of adapted perennial grasses to be permanently retired from crop production and bring in greater returns to the farm by being used for grazing purposes.

The extensive adoption of practices recommended by the committees will bring about a change in the future land use of Gilliam county. While these changes are not expected to affect the type of agriculture being carried on at the present time, they will cause some changes in the acreages of crops now grown. Recommendations for the best use of the acreages of land in the county over a long time period are shown in Table No. 13.

Table No. 13
Long Time Land Use Recommendations

Item	1940 Land Use	Long Time Recommendations
Cropland, total	234,500 Acres	204,000 Acres
Harvested	130,900	106,000
Summer fallow	100,546	96,000
Idle	3,054	2,000
Perennial grass for pasture on tillable land	30,500	61,000
Permanent	20,000	30,000
Plowable rotation	10,500	31,000
Native pasture land in farms	416,760	419,260
All other land in farms	5,914	5,914
Total land in farms	687,674	690,174
Land not in farms	80,966	78,466
Total land in county	768,640	768,640

The development of a unified program for the purpose of solving the problems indicated above, other problems mentioned in the report, and problems not yet developed appears to be the most feasible means of meeting the situation. Such a program requires the cooperation of the local people and local, state, and federal agencies concerned with the agriculture of the county. Through such unified action on problems by the people and all agencies the long time objectives of the land use planning work should be achieved.

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Presented at First
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Conference. Asilomar.
October 18, 1940.

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PANEL DISCUSSION OF

WILDLIFE MANAGEMENT AS A PHASE OF MULTIPLE LAND USE

by

Dr. A. B. Hatch, Chairman (U.S.D.I., Fish and Wildlife Service, Portland, Oregon)
Alan C. Taft (Chief, Bureau of Fish Conservation, California Division of Fish and Game, San Francisco)
Prof. Tracy I. Storer (University of California, Davis)
Everett E. Horn (U.S.D.I., Fish and Wildlife Service, Berkeley)
Gordon H. True, Jr. (Bureau of Game Conservation, California Division of Fish and Game, San Francisco)

Of all the vast array of natural resources which for centuries has made of the North American Continent the greatest military prize of all time, no resource has played a more unique or important role in the development of our nation than wildlife.

Few of the great explorations and even fewer of the famous colonizations which today fill our history texts could have succeeded except for the teeming game which abounded in primeval America. To have provisioned the early stages of settlements and the prolonged American explorations from Europe, in the days of sailing ships and pack horses, would have been incredibly difficult. Instead our early settlers were provided with vast quantities of game for food, for clothing, and even for tools. The buckskin shirt of the American Pioneer, long merely a symbol of a picturesque era, has a far reaching significance in American history.

Without fur in incalculable quantities, the penetration of the American Continent would have been so slow that much of our nation would even today be but sparingly developed. It was the beaver for the high-top hats of the early 19th century which provided the incentive to explore the west and to establish forts and trading posts. And it was the game of the surrounding

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country which made life, far from farming areas, a possibility for trapper and soldier. Vast multitudes of deer, elk, and buffalo facilitated the trek of the 49'ers across the plains, made possible the founding of Virginia City, and the building of the first railroads across the continent. It was the sea otter which brought the Russians to the California coast, and even the founding of the California Republic by rebellion against Spain had as its causative background competition for the famous golden bear.

But all this is by now ancient history. In the American life of today wildlife is no longer important as a source of food and clothing. Deer and elk in the popular mind have become objects of great beauty and aesthetic appeal and large sections of our society fervently oppose the label as primitive and little advanced above Neanderthal man those of us who either for pleasure or livelihood still hunt and trap.

To some of us it seems a curious twist of destiny that a resource which once occupied such an important place in American life should have been relegated to such obscurity, disuse and needless waste. Viewed, however, from the vantage of a knowledge of cause and effect this change in our use of and attitude toward wildlife is a natural and inevitable outcome of the extinction and near extinction of many wildlife species toward the close of the last century. Just as with other natural resources, we used wildlife wastefully for nearly 400 years, then when it was all but gone the conservation movement turned the tide of destruction into one of rigid preservation. Today the protective measures which we adopted thirty and forty years ago to stop extermination are still the common tools with which we manage much of our wildlife. But in common with all living

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things animals reproduce and replenish themselves, and unlike forests most wildlife species require only a few months to reach maturity instead of decades or even centuries.

To replace our finest redwood stands would require from 3 to 5 thousand years. Replacement of our finest deer and elk takes but a thousandth part of this period, a bare 3 to 5 years. A single pair of deer are capable, in a protected environment, of producing 5,000 offspring in a period of 21 years. Single pairs of Hungarian partridge, bob white, pheasants, grouse, and many ducks could similarly increase to the same vast spawn of 5,000 individuals in as few as 5 years. From 20 pairs of muskrats placed in Tule Lake in 1931, ten trappers last winter harvested over 31,000 muskrats and they took barely one-half of the existing population.

It is this enormous reproductive potential of wildlife which sets this natural resource apart from all others and which today makes it incumbent upon intelligent conservationists to revamp the whole of their wildlife conservation concepts.

The problem of wildlife conservation is no longer one of simple preservation. Vast game refuges and narrowly restrictive hunting laws are no longer the keys to wildlife-plenty. Deer and elk no less than cattle and sheep are rapidly renewable products of the land. They are crops which require management and harvesting.

Unfortunately too many Americans think of wildlife not as a renewable crop but as something more comparable to our magnificent western scenery--a thing to be preserved unharmed. We are still thinking in terms of the conditions of wildlife scarcity which obtained thirty years ago when the first great

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wave of the conservation movement swept America.

Actually we have today entered into the third great wildlife era of this country. The first, lasting for nearly four centuries, was a continuous one of destruction by over utilization and by tooth and hide hunting. The second era, beginning early in the present century, was one of conservation by stringent laws prohibiting or drastically restricting harvesting. The measures employed were logical and effective because we had no surplus wildlife and the yearly crop was extremely meager and growing smaller. But today many species of wildlife are overabundant and perishing by the tens of thousands of starvation. We have a surplus which should be utilized instead of wasted, both for humane reasons and because needless waste should have no place in American economy. At the same time many species are still scarce; most fur animals for example are especially rare, some game birds are near extinction. No one policy fits all circumstances. Highly complex measures which take into account the needs of individual species in many localities are required. And most important of all, the third wildlife era in America must be characterized by management measures which enable wildlife to dove-tail with other economic land uses.

In the teeming agricultural and industrial America of today the space available for wildlife is vastly different than it was during our nation's primeval youth. In 1940 men still bewail the tragic disappearance of the millions of buffalo which once covered the plains, of the massive elk, the quisitive antelope, the powerful grizzly. But the lands which those animals once knew as their own are today the homes of millions of people. Tucked away on already overcrowded ranges in the

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mountains of the west, we still possess sufficient wildlife breeding stock to overrun the nation in a few years if we chose to turn our lands back to nature. Why, therefore, continue to lament a destiny which from the beginning was as inevitable as death is to every human. Let's turn our attention instead to the growing problem of assuring an abundance of those species of game which are compatible with established economic land uses. Let's recognize at the outset that neither farmer, forester, stockman, manufacturer, nor in the end the American people as a whole will long tolerate any serious conflicts between wildlife and our individual and national welfare.

Thus the modern problem of wildlife conservation has become one of fitting wildlife into the broad and intricate picture of multiple land use while at the same time satisfying the varying aesthetic, commercial and hunting interests in wildlife which are an inseparable part of the lives of the American people.

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1. ADAPTING WATER CONSERVATION TO THE NEEDS OF WILDLIFE

It seems unnecessary to point out that water is one of the most basic and indispensable of the natural resources of California. Ever since early Spanish days the development of the state has centered around areas where water was readily available for use. Following these early agriculturalists came the placer and hydraulic miners who diverted water from the streams through hundreds of miles of ditches. Later came hydroelectric plants and storage for use by larger municipalities such as San Francisco, Oakland and Los Angeles. The most recent extension of the control of water in California will result from the building of the Central Valleys Project and the construction of two giant dams to control the stream flow in the Sacramento and San Joaquin rivers. It can thus be seen that the steps in the use of water in California were, first, diversion of natural stream flows, followed by a period in which seasonal storage was developed. This latter type of water conservation still predominates.

Water conservation through the maintenance of forest cover has also been important in California and although most of the water so conserved eventually finds

1. ADAPTING WATER CONSERVATION TO THE NEEDS OF VIOLENCE

It seems unnecessary to point out that water is one of the most basic and indispensable of the natural resources of California. Over since early Spanish days the development of the state has therefore revolved around some sharp point that was invariably available for use. Following these early settlements came the miners and hydraulic miners who diverted water from the streams through hundreds of miles of ditches. Later came hydroelectric plants and storage for use by large municipalities such as San Francisco, Oakland and Los Angeles. The most recent extension of the control of water in California will result from the building of the Central Valley Project and the construction of two giant dams to control the stream flow in the Sacramento and San Joaquin rivers. Never has so much been at stake in the use of water in California as here. First, the evolution of natural stream flows, followed by a period in which artificial storage was developed. This latter type of water conservation still predominates.

Water conservation through the maintenance of forest cover has been important in California and although some of it has not so conservat eventually time

its way into storage reservoirs the stabilization of stream flows has been of direct benefit to wildlife, particularly fishes.

It must be said, though, that the storage of water for seasonal use and its diversion from natural stream channels for use in agriculture, power, and mining has done grave injury to our wildlife resources. In 1929 G.H. Clark of the Division of Fish and Game reported that of a total of 6000 miles of streams in the Sacramento-San Joaquin system originally suitable for the spawning of King Salmon, 80 percent had been cut off by artificial obstructions impassable to the fish. This prior reduction of the spawning areas in the Sacramento-San Joaquin has made it extremely difficult to work out any solution for the maintenance of the salmon runs in these streams that will be further limited by the construction of the Central Valleys project. Both the federal government and the state have made plans to minimize the harmful results so far as possible but the future of the once valuable salmon is, to say the least, uncertain.

The interference with the movement of migratory fishes to the spawning grounds where the young would naturally be reared is the most spectacular and obvious way in which our use of water limits the conservation of our inland

fisheries resources but it is perhaps not the most important.

The Division of Fish and Game has record of nearly 1400 dams that have been constructed in the state for the storage and diversion of water and the State Division of Water Resources lists about 600 that are of sufficient size to come under their jurisdiction.

In some cases the water impounded by these dams is beneficial to wildlife but in the great majority of cases it has meant added hazard through unscreened ditches, dry stream beds, daily and seasonal fluctuations of stream and reservoir levels and the drying of marsh lands.

Much damage in the past resulted from the fact that in developing the usage of water for man little thought was given to the preservation of our wildlife resources. Many minor modifications in methods of construction and operation could have been made that would have aided wildlife. Only recently has much attention been given to this phase of water conservation and it should be given further support by all interested in a broad program of conservation.

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Wildlife in relation to Agriculture

I. Basic aspects of wildlife management on various lands are:

1. National parks: complete protection, with interference only to correct disturbances caused by man (e.g. bears, foot-and-mouth disease).

2. National forests: cover disturbances result from lumbering, afforestation, grazing, fire, long-continued fire suppression, water conservation, and recreational uses; changes in wildlife caused by hunting and fishing, by fur trapping, by control of predators, rodents and disease, and by planting of game, fur bearers or fish.

3. Grazing lands: cover disturbances result from clearing, fire, and grazing; wildlife alterations somewhat as on national forest lands, with hunting, control, and game planting of greater importance.

4. Cultivated lands: primary use is crop and live stock production and involves maximum alteration of cover and water; direct and intensive control of pests and competitors; much hunting and fur trapping; some introductions of native or alien game animals.

II. Manipulation of wildlife on cultivated lands includes:

1. Clearing, draining, irrigating, weed control, and other alterations of cover,

2. Crop planting which influences available food and cover for wildlife,

3. Destruction of pests,

4. Regulation of (a) game shooting, (b) fur trapping,

5. Planting or encouragement of cover suited particularly for wildlife.

(Items 4 and 5 [also 3 in part] amenable to farmer-sportsman-trapper adjustments.)

III. Practical efforts possible in behalf of wildlife on cultivated lands are:

1. Protection (complete or partial) of game or fur species against too heavy reduction by hunters and trappers,

2. Provision of cover as by

   a. Leaving field corners and fence lines uncultivated,

   b. Fencing cover along stream courses to prevent undue trampling or browsing by live stock, (fenced lanes give live stock access to water where necessary).

   c. Setting out shelter or food plants,

3. Supplementary feeding in seasons of food shortage,

4. Provision of drinking places where necessary,

5. Limited control of serious predators in clear-cut cases if needed,

6. Planting of game species to restock depleted areas.

Basic [illegible] of [illegible] to [illegible] land [illegible]

1. [illegible] [illegible] complete protection, will [illegible] only to [illegible] [illegible] [illegible] [illegible] [illegible]

2. [illegible] [illegible] [illegible] [illegible]

III. FOREST AND RANGE

Our forest and range areas, both private and public, are renewable natural resources that contribute large sums to our national income. Being renewable they are subject to management so as to perpetuate themselves and produce a sustained annual yield of various commodities essential to our type of civilization. The wildlife, always associated with land areas, is simply another product of these lands. This wildlife, and it must consider all forms from amoeba to zebra, can by virtue of man's economic endeavor, be grouped in three artificial classes. They are beneficial, detrimental or neutral.

Forests and range produce lumber, forage, water, fish, game, and other wildlife, recreation, study areas, and inviolate units closed to all economic exploitation except recreation. Efforts to manage wildlife on these forests and ranges must be governed by the many other uses to which the land is dedicated. On most raw lands beneficial wildlife is a secondary crop and management must be accordingly. Some wildlife whose activities are detrimental become primary factors when they affect the major uses of the land.

Failure of regeneration of sugar and ponderosa pine shows that the biologic factors are of equal or greater importance than climate or soils. Some cut-over and burned areas are regrowing to brush that excludes merchantable conifers. Timber cutting or fire opens the areas, annual plants and shrubs come in. Under such conditions mice, chipmunks and squirrels increase. The conifer seed supply has been reduced. More rodents feed upon a less abundant seed supply. Shrubs increase, offering rigid competition to such conifer seedlings as become established. On the sugar pine-fir forests of the Stanislaus, white fir, incense cedar, and brush are replacing the economically valuable sugar pine; and rodents are a large factor in bringing about this change.

In attempting to reclaim some California brushfields, plant competition has been lessened by clearing strips in the brush with trail builders. Pines planted in these strips have been badly damaged by cottontail and snowshoe rabbits. On some large plantations rabbits have been the primary cause of low transplant survival.

Three forms of wildlife management are suggested in these instances.

1. Remove the detrimental animals until pines are established.

2. Create a habitat condition so detrimental to these animals that but few can exist.

3. Take advantage of the fluctuation in numbers of these animals, especially rabbits, and plant when they are at the low point in their cycle of abundance. At present, removal of animals is abhorrent to some people; creating unfavorable habitat is ideal, but dependent upon the adaptability of the animal; and taking advantage of fluctuations in numbers requires an extremely flexible planting program.

Wildlife and Range Utilization

On the range, wildlife consumes forage that might otherwise be utilized by domestic livestock. In cases of larger grazing animals, such as antelope, deer and elk, it is a question of how many head of wildlife and domestic stock can be carried on the same range without overusage. It must be borne in mind that our present economic structure dedicates much of the range area to forage production for consumption by domestic stock. If more wild creatures are desired a proportionate reduction in domestic stock is essential, and such management practices as predator control, water development, regulation of the annual kill, and maintenance of a proper sex ratio are some steps to be applied as local conditions dictate.

One of the greatest problems in the proper management of our California deer herds is the balance between adequate summer and winter range. Much winter range is on privately owned lands.

Range-inhabiting rodents consume forage that would otherwise be available for domestic livestock or other grazing wildlife. Their burrowing does an undetermined amount of good in soil cultivation and fertilization. Additional research is essential to replace biological speculation with sound factual data.

Some range men reduce certain rodents by means of poison. Some biologists recommend rodent suppression by light grazing or nonuse, thereby creating a dense growth of vegetation unfavorable to certain rodent species. On our annual type of range in California such nonuse tends to suppression of the more valuable forage plants and predominance of low-value grasses.

Range lands are the home of several upland game birds, and the sagehen, for one, has suffered by contact with domestic livestock. Fencing of small areas about water affords breeding areas and does not interfere with the use of range by livestock.

Watersheds

Water, not timber nor forage, is the chief raw crop of some of our brush-covered raw lands. Some of these areas are veritable faunal paradises where deer, quail, doves, coyotes, cats, foxes, and others abound. Human use must be restricted to water production because of the fire hazard. A study is being made to determine the feasibility of a management plan, slightly changing the deer season to a non-fire hazardous period and to deer management coordinated with water production.

Summary

Land use should be the keystone around which to build our structure. The mountain lion, coyote, fox, cat, coon, skunk, and others are both fur bearers and predators, depending upon economic endeavor. These animals feed, among other things, upon rodents. Removal of rodents would mean partial removal of their food supply. It is not a proven fact that any single predator acting alone limits any single rodent species. The interrelationship of all plants and animals affords the basis for planning the details of wildlife management, and the application of these practices must coordinate with sound land use, determined by economic necessity.

4. WILDLIFE AND ITS USE BY THE PUBLIC IN RELATION TO LAND USE.

The boundaries of the State of California include 100,000,000 acres of land. Sixteen million are in public domain and approximately 20,000,000 acres are in national forests and parks. The remainder is largely in private ownership. Only 15,000,000 acres of the grand total are under intensive cultivation, the balance, speaking in round numbers, is what is generally termed "wild land."

Still speaking in general terms, it is safe to say that every acre in California is capable of supporting some kind of wildlife and it is necessary that this tremendous wildlife population be so managed that there will be both a harvestable surplus sufficient to meet the needs of the public and a minimum amount of conflict with other land uses.

People in general are interested in wildlife both from the standpoint of the hunter and the fisherman and from the standpoint of aesthetics. There are those, however, that are interested only in the harvest and those who are opposed to any killing whatsoever. These two minorities must be brought together with the larger group that, while appreciating the aesthetic value of wildlife, recognizes the necessity for and enjoys the harvesting of the surplus.

In California, approximately 250,000 hunting licenses and more than 400,000 fishing licenses are sold annually. Deer tag sales which approach 150,000 indicate the amount of interest that the public takes in deer hunting alone. The number of persons who derive pleasure merely from observing wild animals and birds in their natural habitats is incalculable.

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In California, approximately 200,000 hunting licenses and more than 400,000 fishing licenses are sold annually. Deer tag sales which approach 140,000 indicate the amount of interest that the public takes in deer hunting alone. The number of persons who derive pleasure merely from observing wild animals and birds in their natural habitats is incalculable.

In addition to possessing sporting and aesthetic values, wildlife is a tremendous commercial asset. It has been determined conservatively that California license buyers spend more than eighty million dollars annually in the pursuit of the sports of hunting and fishing.

There is little doubt that an increase in the amount of wildlife in California would result in a corresponding increase in the annual harvest, but in the case of some game species, particularly big game, there is a definite limit beyond which wildlife comes into conflict with other land uses. Wildlife populations must be kept within reasonable limits if we are to keep the good will and cooperation of other users of the lands they occupy.

The cultivation of land for the production of agricultural crops is the use with which wildlife most commonly conflicts. In several localized areas throughout the state, deer have increased to such an extent that vineyards, orchards, alfalfa, and other crops are suffering varying degrees of damage. Ducks, now on the increase, have come into conflict with the rice industry. Pheasant, in a few instances, have been considered objectionable by growers of tomatoes and other truck crops. In areas devoted to grazing there has been competition between deer and livestock where relatively small acreages of range land are heavily used by wintering deer hords. By and large, however, California's wildlife habitats have not reached the saturation point, and every effort is being made to build up game populations in those sections of the state where other land uses will not act as a check.

The public is, at the present time, faced with a difficult* problem—that of securing adequate hunting and fishing expense. This situation has arisen because (1) hors and more lands have been closed by the creation of refuges and parks, (2) because there has been an increase in the number of private hunting clubs, and (3) because a small percentage of sportsmen have shown a disregard for property rights that has resulted in the closing, each year, of more private property. In the last week, a majority had suffered as a result of the misconduct or thoughtlessness of a small minority. There is a crying need for improvement in the relation of the urban-dwelling sportsman and the land-owner. The public has no need to bring this about.

In some cases, conflict between wildlife and other land uses has been the result of the activities of those who in their real for "conservation" have been responsible for the closing to hunting of large areas of wild land. The result has been an inability on the part of the states to manage their big game herds. The consequences have been disastrous in many parts of the East. California has been more fortunate in this respect than many of the other western states, but even now is faced with the problem of managing the deer herd that summers in the Yosemite National Park and descends to its winter range in such numbers that the supply of forage has been really depleted.

In considering the problem of the correlation of wildlife management with multiple land use, it is to be regarded as unfortunate that the public has not allowed its legislators to enact land enabling the proper authorities to deal with

local game problems without affecting wildlife populations as a whole. Wildlife cannot be managed by the application of inflexible rules that are state-wide in scope.

To summarize, emphasis must again be placed on the need for adequate legislation; for bringing about a better relationship between the farmer and the sportsmen; and for bringing together on a common ground the sportsmen, those who are opposed to harvesting a game crop, and the commercial interests.

C7.

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Economics

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THE MICHIGAN LAND ECONOMIC SURVEY

Henderson, B

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A Report
on its
Scope and Progress

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Between pot-boilings, this is the thing which, for several years, has absorbed most of my interests + energies. It has, I think, just about done the job. The idea of engineered land utilization has soaked in deep in Mich and is going into Wis + Minn.

P.V.K.

Washington, D. C.,
December, 1924.

THE MICHIGAN LAND ECONOMIC SURVEY.

By B. Henderson, Assistant Agricultural Economist,
Division of Land Economics.

The State of Michigan has made notable progress toward the development of a land policy through the establishment of its Land Economic Survey. This Survey, which is under the supervision of the State Department of Conservation, is well out of the experimental stage. For three years it has been carried on successfully and has accumulated a large fund of systematic information about the economic resources of Michigan land.

The Survey is charged with making an inventory of the natural resources in the sparsely settled counties in Northern Michigan and in the Upper Peninsula. One-third of the State has been cut over, burned over, and left to shift for itself. Approximately 10,000,000 acres of land are virtually waste and idle. Before private owners and state officials can formulate a policy for the administration and profitable development of these vast stretches of idle land it is necessary that they have specific dependable information to answer such questions as the following:

How much of the idle land is suitable for agriculture? Where is the cultivable land located? What is the soil? What are surface and drainage conditions? How much will it cost to get the land ready for agricultural use? What are the marketing, transportation, educational and social conditions offered the prospective settler? How is the same kind of land under like conditions being used by other farmers? What is the definite location of the non-agricultural land? What is the location and character of the land on which unsuccessful settlement has been attempted?

How much of the idle land can or should produce commercial forests and eventually meet the problem of the high cost of imported lumber and coal and the ever-increasing freight rates? How much of this land is reforesting itself? What kind of timber is it growing? What kind of trees grew in the original or virgin forest? How much has been burned over so often and so severely that all prospects of valuable second growth have been destroyed? What part of the land can or should be used for forest plantations? What returns may be expected from different types of plantations on different soils?

What do these lands offer in the way of water power, power sites, and water storage facilities?

What do they offer to the constantly enlarging stream of tourists? Where can these tourists find the best lakes, streams, and woods for summer camps and playgrounds? What attractions and resources are there for hunters, fishermen and other sportsmen? What parts of the land will make good game preserves for State and private reservations? What lakes offer advantages for resort development?

What is the nature of the land that is reverting to the State for delinquent taxes? The State has already acquired title to about 700,000 acres in forfeited tax titles and the records show that 5,000,000 acres

more are delinquent. Between March 1, 1923, and November, 1924, a period of 20 months, 61,271 acres reverted to the State. What policy shall be adopted under which this land may be made to yield an income to the State? What plans for utilization and cooperation may be suggested or advised so as to enable the owners of these idle tax delinquent acres to so use them that they will at least produce taxes and carrying charges?

All these and many other questions need answers. Nobody knows the answers except in the vaguest and most general way. No records, statistics, or reports in State, country or private files furnish this information. It must be collected in the field, assembled, tabulated, interpreted, and put in usable form. In spite of all previous efforts, the area of idle and unproductive lands has steadily increased. No policy can be adopted to meet the situation until full and dependable information is available, or until an inventory of the idle land has been made.

The Land Economic Survey was created to attack the problem. It consists of a regular year-round staff of five experts, one of whom is the director and forestry specialist, one a land economist, one a professional soil surveyor, and two are experienced general assistants. In addition there are field surveying crews for summer work made up of about 15 additional men. Nine or ten of these men are recent graduates or advanced students from the agricultural college and from the State university, and the remaining four or five are professional soil surveyors from the United States Bureau of Soils and from the Soils Department of the Agricultural College. Auxiliary lines of work are carried on by other departments and institutions of the State. The State geologist's office studies and maps the economic geology and the geological history; hydro-engineers from the State university inventory the water power resources; and other divisions of the Department of Conservation study game covers, game-carrying capacity, and fish and fur resources.

Field data recorded by the surveyors include the following phases: Soil identification and distribution; general surface relief and drainage; vegetation cover, both native and cultivated; economic conditions; resort data and recreational possibilities; inventory of water power resources; geological data including information on deposits of shale, limestone, gravel, marl, etc.; stream data for fish, fur, and game; and general and miscellaneous scientific data. Each of the staff specialists - the forester, the soil surveyor, and the land economist - directed and supervised his own part of the work in the field, and the two assistants did the necessary camp administration work.

Up to date the Survey has covered five counties--Charlevoix in 1922, Ogemaw and Antrim in 1923, and Roscommon and Alpena in 1924. The aggregate area of the counties surveyed is 1,629,691 acres, and the average cost of the field work has been less than 5 cents per acre.

The office work on Charlevoix, Ogemaw and Antrim counties has been completed and the maps are ready for publication. The data for Roscommon and Alpena counties, collected during the summer of 1924, are being worked up and will be ready for publication early in 1925.

The land surveyed has been in most cases crossed twice in the mile so that no point was more than 1/4 mile from the surveyor. Frequent side trips are made by the men so that where needed almost every acre of the mapped land is covered by the surveyor.

When the summer season closes the field crews are dismissed and the work is transferred to the departmental headquarters in Lansing. During the winter the staff men assemble the field data on maps and in charts and graphs, and interpret and amplify the information in written reports. The work is then checked, smoothed up and edited for publication.

The policy of the Survey has been to consider itself a purely inventory-taking organization. It attempts no general advice, makes no prophesies, and proposes no plans or policies for land use. Its function stops when it gets and makes plain the essential facts upon which any competent plan for farm, forest, or recreational development must be based.

By means of the data furnished by the Survey the people in the wealthy, highly-developed parts of the State are given strikingly concrete evidence that they personally are concerned with the 10,000,000 acres of idle land.

They are given information about the possibilities for recreation, for camping, for fishing, for hunting, etc., that exist in the wealth of inland lakes and on the rivers in these wide stretches of unsettled lands. At the same time people wishing to invest in resort or lakeside property are assisted in its selection and through a careful study of the records may avoid swindle or exploitation.

Every individual in the State who feels the pinch of the high cost of imported lumber is interested in the forest and timber records taken by the Survey.

The general public is shown the amount of water power on the undeveloped streams and the feasible sites for power development that can be made to furnish electricity for the local communities or for down State industries.

They are shown that in these sparsely settled counties the State has put much more money into the counties than it has recieved from them in taxes. As an instance, between 1905 and 1922, one of the best counties surveyed paid into the State treasury $357,309 and received from the State during the same period $676,756.61, leaving a deficit for that one county alone of $319,447.61. The tax money put into this county over and above what the county had paid into the State had to come out of the pockets of the more prosperous parts of the State. In 1922 there were 47 counties that received State money in excess of that paid into the State varying from $10 per county to $59,500 per county, and only 36 counties that contributed an excess over their receipts varying from $2,000 to $3,600,000 per county. The man on the street in any one of the richer counties can see in no unmistakable terms the drain on the State treasury brought about

by this condition and he realizes that the loss must be replenished at least in part from his own pocket. The Survey is attempting to inventory and locate resources by means of which a policy may be worked to make these counties at least self supporting and stop this annual drain.

Not so directly touching the personal interest of the individual citizen, but nevertheless of vital concern to all public-minded people is the reputation of the State as to fair dealing in land sales opportunities for agricultural development and profitable investment of capital. This reputation has been jeopardized by the exploits of unscrupulous land dealers who have sold hopelessly low-grade land to thousands of unwary innocent purchasers. Thousands upon thousands of abandoned fields, miles of rotting fence posts, old cellar holes scattered over entire townships. Jackpine saplings two or three inches in diameter growing between the wheel tracks of old section line roads are monuments to the dead hopes of agricultural development on land that is not suited to cultivation. It is not possible to show tangible evidence of the physical and mental suffering and the tremendous loss in money that went into these ruined enterprises.

The Survey shows to the would-be purchaser in dependable detail the location and nature of the land that will grow farm crops, that which is dubious for farming under present conditions, that which is chiefly valuable for forest crops, and that which is of greatest value for recreational use. When the Survey is completed and its reports are available for distribution any would-be purchaser will have access to information about any parcel of land that has been surveyed. He may ascertain the kind of soil he is buying, the economic location, the tax history of the community, the changes in population that have affected the township, and the kind of farming that is being practiced on like land under like conditions. If he wishes to invest for future lumbering or other industry he may ascertain the original forest growth that covered the land, the present growth and its conditions, the types of soil, the drainage, topography, power and transportation facilities, etc.

The work of the Survey has brought out some striking facts in land economics in the counties already surveyed. For instance, in Roscommon County the land held in resort or recreational ownership makes up 2.4 per cent of the total area of the county but furnishes 28.3 per cent of the county's assessed valuation; general absentee ownership covers 28.5 per cent of the area and furnishes only 22.4 per cent of the assessed valuation, and the records show that a large percentage of the absentee ownership land is tax delinquent and a burden to the county and the State.

In Ogemaw County out of a total area of 365,962 acres, 14 per cent or 51,465 acres is high sandy plain land; 23 per cent or 83,008 acres is low sandy plain; 20 per cent or 73,392 acres is hilly sandy land; 33 per cent or 123,241 acres is rolling upland with loam soils; and 10 per cent or 35,896 acres is smooth rolling upland with loam soils. In the high sandy plains only 3.9 per cent of the land is in resident farm ownership; in the sandy hilly land 17.3 per cent of the land is in resident farm

ownership; in the low sandy plain about 27.7 per cent is in resident farm ownership; while in the rolling uplands with loam soils about 64.4 per cent of the land is in resident farm ownership, and in the smooth rolling uplands with loam soils about 43.6 per cent is in resident farm ownership. In this belt of loam soils there was little evidence of farm abandonment and the census figures and crop tallies show that the farms are reasonably profitable and successful. The data also show a remarkable coordination in the adjustment of types of farming to types of loam soil and favorable topography.

In Antrim County out of a total land surface of 303,047 acres, there is 75,789 acres of mixed hardwoods such as basswood, elm, ash, and maple, varying in diameter up to 12 inches with 48,057 acres of this growing in good dense stands. There is nearly 40,000 acres of mixed hardwoods made up of maple, beech, yellow birch, etc., varying in diameter up to 12 inches and over, with the majority of it dense enough to provide good forests in the near future; 21,217 acres are carrying a second growth of poplar, whitebirch, and hemlock sheltering a scattering growth of young spruce balsam and white pine. There is 18,408 acres covered with fire cherry brush that makes good game cover, 4,693 acres of recent burn, 1,854 acres of new slash, and several thousand acres of low wet ground carrying other timber growths. Cropped land occupies only 93,376 acres or less than 31 per cent, there is an area of 11,264 acres of abandoned farm land, 14,715 acresof pasture, most of it in stumps, and 2,687 acres of orchards. Census figures show that with one exception, the population is decreasing in every township. These figures seem to point to the future trend of development if Antrim County is to remain solvent.

The work of the Survey has attracted widespread attention. Requests for information as to its methods and results have come from a number of States and from the Dominion of Canada. The Institute for Research in Land Economics and Public Utilities at Madison, Wis., has asked for a report of the work and for a file of the maps and charts prepared by the Survey.

In the Great Lakes cut-over region including parts of Michigan, Wisconsin, and Minnesota there is an area of approximately 40,000,000 acres comparable to the land which has been or will be covered by the Survey. The work of this Survey is the only attempt to date on the part of any one of the State governments to inventory the resources and to assemble the information that will enable them to work out and adopt an economic policy for the utilization of this great area of unused land.

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Hill, C. L.

TENTATIVE OUTLINE OF LAND USE STUDY

FOR CALIFORNIA*

Natural Resources Committee
California Economic Research Council

Coordination of uses of the total land resource, as a subject for professional study with a view to constructive guidance, is new and standard procedure is wanting. The present outline suggests principles and a method of approach to the problem of land use in California as a first concrete set-up for committee consideration and revision, in the attempt to arrive at a program of investigation and action which shall command the assent and cooperation of interested agencies.

Principles Involved

1. The Problem. The ills resulting from planless past utilization of land are upon us and the need for correction of past errors is immediate. The traditional American assumption that increasing population would continuously press upon all the food supplies which could be produced and therefore that the one needful utilization of land was to turn it into plow land as completely and as rapidly as possible, has largely contributed since the war to widespread agricultural distress, in the face of conditions unforeseen by this formula. Since the war practically a million farmers have abandoned their farms, to add to the congestion of the cities, and many others are still hanging on grimly who will have to give up. Reclamation projects created without a forethought to the signs of the times have added to the distress. Meanwhile the area of forest cut-over land is increasing yearly and millions of acres of lands, unadapted to agriculture but capable of growing forests needed by this and future generations, are lying idle, too often swept by repeated fires. Grazing lands are overstocked. Fire, over-grazing and unwise cultivation are resulting in soil erosion which is destroying the fertility of millions of acres annually, and even destroying the possibility of any productive use of great areas, at the same time filling water storage reservoirs with the resulting silt and debris. Thus water conservation in relation to land cover has become a critically important problem.

Not only, then, are millions of acres farmed which are below the margin of profitable crop production, but millions of acres are put to all sorts of uses which are far below the optimum. Possibilities of improvement are apparent. Perhaps in no direction at the present time does the public good demand more urgently the

author, chairman

*Prepared for the Committee by C. L. Hill, Committee Chairman (Senior Forester, California Forest Experiment Station) and Professor David Weeks, Committee Member (Professor of Agricultural Economics, University of California). This draft embodies revisions suggested for submission to the whole Committee, at the meeting of February 25, 1930.

the application of the best thinking of which the nation is capable, to the end of "substituting intelligently directed land utilization in the place of haphazard development and use".*

*Given as the definition of land planning in "What About the Year 2000? An Economic Summary". Joint Committee on Bases of Sound Land Policy, Washington, D. C., 1929, p. 136.

2. The Objective. The objective of land use study and planning is ultimately the guidance of land use so as to secure the greatest public good; "making the best possible corrections for mistakes in the past and preventing more errors in the future".** It will thus been seen that the distinguishing features of

**Ibid. p. 137. This Committee also says, "The purpose of a land policy is to promote the welfare of the group by making it possible for the individual members to maintain and improve their standard of living. Land-planning is not contrary to individual liberty, but it means that the group modifies or rearranges the individuals' rights, privileges, opportunities, and obligations in such a manner that the general welfare of the entire group is increased." Ibid. p. 136.

land planning are its emphasis upon the public or social point of view, and upon the necessary coordination of the utilization of specific pieces of land to the major needs of the social unit in the utilization of the total land resource. To accomplish such an objective land planning must include more than a mere inventory, such as has been its limit in some states, while at the same time avoiding carefully the opposition sure to follow compulsory application of classifications.

3. Need of a Plan. A flexible plan, based upon the best available knowledge, is essential to the realization of this objective. A plan is as necessary to the effective assembly of data and the study of their significance as to the wise application of ultimate social guidance. The magnitude and complexity of the problem, as well as the inadequacy of present knowledge to ultimate measures of control, may freely be acknowledged without detracting from the obligation to attack the problem at once. The chief requisite of a plan, after soundness and adequacy, is such flexibility as through periodic revision can progressively adapt it to new facts and new conditions.

The Plan

1. Purpose of the plan. Such a plan should serve:

(a) in the formulation of working hypotheses for the guidance of research;

(b) ultimately as a basis for social direction of land utilization, in the interest of public welfare.

The plan will gradually evolve from that for (a) to that for (b).

2. Essential features of the plan. The major features of such a plan, at the present stage, would include:

I. A preliminary general classification of lands according to their present utilization and their physical and economic characteristics, on the bases of present knowledge or that which can presently be assembled.

II. Critical analysis of the tentative classification results, and development both of detailed data and a technique which will provide bases for identifying different combinations of physical and economic land features, and determining their different adaptations and optimum uses; culminating in correction, revision and completion of classification.

III. The formulation of a consistent land policy for the state, in accordance with the accepted findings of the classification work, together with appropriate means of rendering effective the guidance and direction of actual land use toward the common good and of maintaining the classifications and their application abreast of changing conditions.

Headings I and II represent the same general process, successively applied. In I it is applied broadly and tentatively only, because necessarily on partial and imperfect data, with partial and imperfect technique. This first (and admittedly imperfect) classification structure is, however, essential:

(a) To provide, in answer to immediate need, at least broad criteria for a policy and practice better than can be projected under the present lack of accepted criteria;

(b) To clarify the blocking out of the problem and to unify diverse minds upon the form and content of its more adequate solution.

In II the process is repeated, upon more precise and abundant data and with new and improved tools of analysis as the means of accomplishing a more accurate and widely dependable classification. It must not be overlooked, however, that the constantly changing complex of human conditions will permit no classification to be "final". All that is contemplated here is that the classification arrived at under II, because based upon a more thoroughgoing analysis of a much more comprehensive body of facts, will constitute a more adequate basis for a sound land policy than will be possible in the earlier work under I. It can continue to function satisfactorily in this capacity, with proper provision for keeping both classifications and policy abreast of changing conditions. Sections I and II of the above plan outline are further developed below.

I. Preliminary classification of lands

A. Assembly of present knowledge. There is much knowledge, in isolated compartments of study, but no one has yet assembled and evaluated it from the standpoint of the whole problem of land use as applying to California. Assembly should be done by specialists in the several lines who are thus willing to cooperate, through the medium of the Natural Resources Committee. For this purpose the Committee could be enlarged to include the specialists, according to accepted Research Council procedure, as recently applied in the study of the state water plan, under the Irrigation Economics Committee.

B. Joint study and analysis of the data by these specialists, and appraisal of their adequacy; planning for the securing of needed information which is not available and for such investigation as is most important.

C. Tentative classifications of California land resources, in broad outline, on the basis of assembled information, supplemented by general field surveys as needed.

1. Classification by present use (preferably on a topographic and drainage map base). This would be first by major uses, namely, agriculture, grazing, forestry, water supply, recreation, urban. Any of these may be primary and control all others. They may be mutually exclusive, but are not necessarily so, and where they overlap may then coexist on the same land. Major uses may be subdivided as seems expedient. Obviously the most critical areas (and most difficult as well) are those marginal between major kinds of use.

2. Classifications by physical and economic features.

3. Tentative summarization of 1 and 2 in a map approximately outlining the fully developed, under-developed and undeveloped land areas of the state, with acreages, in relation to present use.

The classifications by physical and economic factors (I, C, 2) to the extent that they can be carried out with present knowledge, will furnish the starting point for a much more intensive study, with a view to the sound determination of best use of land, and the revision and completion of the land classification, under heading II.

II. Critical Analyses and Development of Technique

A. Resurvey of current status of the problem, for the purpose of:

1. Determination of what essential data are still wanting.

2. Further development of technique and procedure.

B. Detailed surveys and analyses of sample areas, selected as typical or critical from the several general classes established under I, C. This intensive study of representative sample areas is to provide the detailed data, necessary for the further activities under subsequent headings, but which it cannot reasonably be expected that resources will be sufficient to obtain for the entire land area.

C. Development of indicative criteria for the appraisal of best use of land areas, and working out of bases for generalizations by classes, through correlation from sample areas and information previously assembled, of the physical and economic factors governing land utilization.

D. Checking of accuracy of previous land classifications, by application to local areas of the criteria of best use developed under C.

E. Revision and completion of classification.

No attempt is here made to elaborate section III of the plan. The means, educational or otherwise, by which public acceptance can be secured for a matter so complex and so far reaching as a land classification can only be felt out by the aid of the cumulative experience gained in the upbuilding of the classification and its application; and a land use policy, which will be an end product of the process, can be forecast to no purpose at its beginning.

Appendix to Plan

For the benefit of concreteness, both in the plan and in its understanding, there are added below suggestive developments of two headings, I, A and II, C. of the above outline. These will illustrate the extent of the fields within which data must be assembled (I, A) and analyses made (II, C).

I. Preliminary classification of lands

A. Suggestive Outline of Information to be Assembled

1. Natural factors - by maps wherever these can serve.

(a) Physical bases

1. Geography - drainage, topography, culture; areas held by major ownership classes (federal, state, private); effect of elevation, slope and surface conditions upon land use, agricultural and otherwise.

2. Geology - especially as affecting minerals and soils.

3. Soils - classifications on broad similarities in relation to agricultural, forest and grazing uses.

4. Climate - effect in limiting agricultural crop production and other land uses.

(a) Precipitation - average annual, form, variation, seasonal distribution and character, behavior of maxima and minima periods; fog, humidity, evaporation.

(b) Temperature - average annual, variation, seasonal distribution, early and late frost areas and frost drainage.

(c) Insolation - seasonal variation.

(d) Winds - direction, velocity, seasonal variations; storm courses and behavior, lightning belts, etc.

(e) Correlations - especially Koppen classification (Russel modification for California).

(b) Vegetative cover and culture

1. Vegetation - types and distribution

   (a) Original, as far as can be determined

   (b) Present

   (The California Forest Experiment Station of the United States Forest Service is engaged upon such a vegetative type map, to cover all but agriculturally used land.)

2. Forests - virgin by volume of stand (types provided in "e"); cut-over and/or burned-over, by reproducing merchantable, below merchantable, nonreproducing, brush, etc.; All by ownership classes, federal (National Forest, National Park, Indian Reservation, unreserved domain), State (Park, Univ., School), private (Lbr. co. operating, non-operating, ranch, other). (The United States Forest Service will soon be conducting a forest resources survey which will be of great service.)

3. Grazing - by forage types, condition, and ownerships. (The United States Forest Service has detailed data within national forests.)

4. Farm acreages - by Census classifications. (The census classifies material under these headings as follows: Total land area; per cent in farms; acreage of land in farms; farm land classified as crop land total, harvested, crop failure, idle or fallow; pasture land classified as total, plowable, woodland pasture and other pasture; woodland not used for pasture.)

(c) Water supply and related factors

1. Water supply - surface and subsurface; developed and potential.

2. Irrigation - irrigable now irrigated and not irrigated, irrigated used and not used; with source of irrigation (surface or subsurface.) Forecast, as data become available, of probable changes consequent upon new major proposals, such as the present state comprehensive water plan. (much work is still necessary on this subject; for example, the term irrigable does not mean the same to different persons, and needs precise definition. Prof. Frank Adams has much data in the irrigation field, and the land classification being made by the State Engineer for that state water plan will largely cover this ground.)

3. Water power - developed and potential; trend and rate of development: probable effect upon use of watersheds, and upon probable agricultural and industrial development.

4. Erosion in California - its relation to kind of soil, slope, burning off of vegetation, agricultural cultivation, etc.; effects upon agriculture, water storage, irrigation and power, and possible land use restrictions necessary on account of erosion, with areas where to be applied. (Very significant quantitative experimental work on erosion and the water cycle is being conducted by the California Forest Experiment Station of the United States Forest Service.)

(d) Utilizations other than for vegetative crop growth

1. Extractive industries - distribution of mineral resources; areas held for mining, petroleum, quarrying, etc.

2. Recreation - parks, forest recreation areas, wilderness and research areas; fish and game resources, refuges. By ownerships. Effect upon land use.

3. Urban and industrial

2. Economic Factors

(a) Production and marketing

1. Agricultural crops and forest and other soil products - annual production, value; distribution of crop acreages and livestock population.

2. Market for crops and other land products

(a) Location, character, volume consumed, comparative prices, stability, etc.; effect upon commodity realization, by marketing unit areas.

(b) Characteristics of demand for different California products; trends in California, United States, and foreign consumption, as related to California products.

(c) Data on domestic and foreign trade, competition, and potential markets.

3. Transportation in relation to markets; effect of freight differentials on California products in significant markets, in competition with similar products produced elsewhere.

4. Producing investment as affecting different products and uses of land - fixed operating, other; indebtedness, mortgage, bond and other, per acre or other significant unit.

5. Costs of production - direct, indirect, total; changes in response to conditioning factors.

6. Economic bearings of soil fertility

   (a) Possible changes in farm management and practice which may affect crop yields and financial returns.

   (b) Waterlogging, hard pan, alkali accumulation - where most serious in relation to soil management and crop yields; possibilities of improving soils and crop yields by removal of these hindrances.

(b) Bases of stability

1. Measures of economic status - net income, standards of living, output per unit of input, etc.

2. Taxation - present status as applied to lands under different major uses; tax delinquency, land reversion and their effects upon community prosperity and solvency; possible changes in taxation structure as applied to special classes of land, such as forest land. (The United States Forest Service will soon reach California in a nationwide study of forest taxation, which will be of great assistance.)

3. Land tenure, and the effect upon it of investment burden, methods of financing and mortgage or bond indebtedness, taxation, etc., in relation to earning capacity; farm abandonment, etc.

4. Population - distribution in density, character; trends; effect of population increase and ultimate equilibrium point, national and state, on demand for California soil products and on land utilization here. (population of the United States is predicted by Raymond Pearl and O. E. Baker, on largely independent bases, as likely to increase within this century to an approximately stable maximum of 175 million to 200 million. Two estimates* on independent bases indicate

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*Bonner, Frank E. Report to the Federal Power Commission on the water powers of California, 1928, p. 28.

Show, S. B. and E. I. Kotok, Unpublished results, United States Forest Service, California District.

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that the population of California will double within the next 30 years and will increase to a maximum of approximately 14 million by about 1985.

II. Analysis and Development of Technique

(A. and B. - no elaboration)

C. <u>Analyses and correlations, looking toward the determination of optimum use of land involve:</u>

1. Under land classification on the basis of natural characteristics:

   (a) The development of various measures of productivity and the determination of their limitations and possibilities.

   (b) The identification of different growth potentialities by such criteria as are available or can be developed.

   (c) The classification of these potentialities in accordance with criteria of site classification either now accepted or to be developed.

2. Under classification on the basis of economic potentialities:

   (a) Cost and income studies. These will be used:

      1. To determine net income for the purpose of (a) measuring the probable income producing power of different classes of land when utilized for similar purposes; (b) measuring the probable income producing power of a given class of land when devoted to the production of different classes of products; (c) determining the standards of living which may be maintained by different classes of land devoted to different uses.

      2. To measure the relative efficiencies of different classes of land by determining the quantity of product from each class in terms of the amount of labor and capital required to obtain that product.

      3. To make possible the determination of the total quantity of labor and capital which can be economically applied to a given class of land when utilized for different purposes, or to different classes of land when utilized for the same purpose.

      4. To form the basis of correlations between any one or all of the above determinations and the physical and cultural characteristics so that the results of cost and income studies may be applied to extensive areas without the expense incident to the detailed collection and analysis of accounts.

   (b) The selection of indexes of economic conditions within an area and the determination of their adequacy in measuring the effect of environment. Illustrations of such indexes are: numbers of abandoned farms, extent of tax delinquency, condition of buildings, land values, tax rates, county or town income, rate of population increase or decrease, facilities for education and administration of other social needs, etc.

(c) Correlations between physical, economic and cultural features, for the purpose of determining the relations which exist in general between different commonly found combinations of land characteristics and utilization. These relationships, determined in more or less stabilized land developed situations will be useful in the interpretation of the potentialities of the less stabilized or less developed sections.

(d) The study of the histories of different cultural patterns with the view of forecasting the probable or optimum utilization through the various stages of development.

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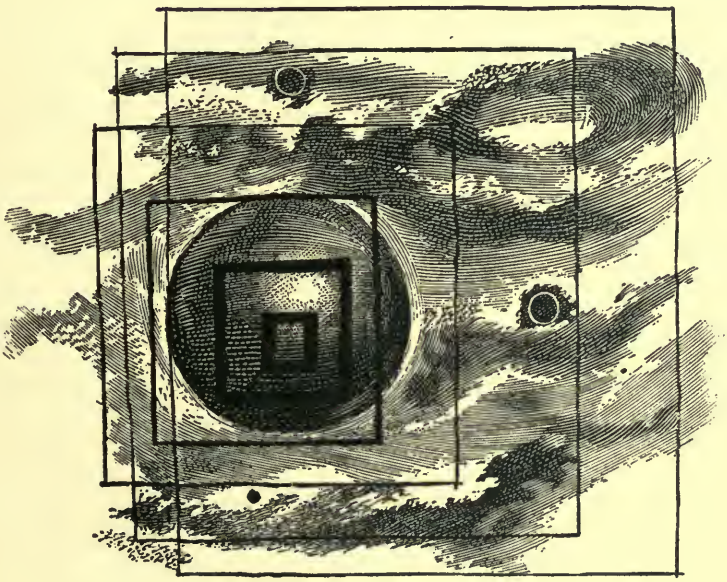
OUR INEXHAUSTIBLE RESOURCES



An *Atlantic Monthly* article by EUGENE HOLMAN

STONE
BRONZE
IRON
STEEL

Our Inexhaustible Resources

ALL OF US who are in any way connected with natural resource industries — geologists, engineers, executives, investors — are even more concerned than most people about how fast we are using up our natural resources. These materials have a vitally important place in the pattern of human existence, and people frequently fear that we are going to run out of one or another of them. We worry about "wasting" our resources or "exhausting" them. But I suggest that the viewpoint expressed in those terms "wasting" and "exhausting" is a partial viewpoint. I think that under certain circumstances we can forget our fears and entertain the notion of inexhaustible resources.

Let's look at the record. It shows that from earliest times men have used minerals drawn from the earth. And we see that the availability of larger numbers of minerals, in greater quantities, has progressed by a kind of steplike process.

Archaeologists have shown us that prehistoric men used axes, drills, and other implements made of flint and other hard stone. With these tools they were able to create simple societies, which in turn made possible the accumulation of knowledge about the natural world.

The Stone age developed both the instruments and the knowledge which enabled men to use certain of the softer metals, especially copper and tin. Humanity then stepped up to the Bronze age. Now man had more tools and more serviceable ones. He could fell trees faster and thus have more buildings for shelter and more vehicles for transport. He could dig deeper and fracture rock more readily. He could move more widely than before over the earth.

As the men equipped with bronze tools learned more and more about the world, humanity stepped up again — this time to an age of Iron. Now man began fashioning a really formidable array of

tools. He had new power to cut, grind, hammer, and otherwise work materials. He could handle masses of material with stronger levers, wedges, pulleys, gears, hooks, eyes, and pincers.

In modern times the age of Iron has given way to the Steel age. And within our own lifetimes there has been superimposed on the Steel age what we may call the age of lightweight metals, plastics, and atomic fission.

Our Inexhaustible Resources

From the Stone age to the present so great a wealth of scientific information has been amassed—most of it in the past hundred years—that we now have tools and instruments of a power and precision beyond all previous imagination. We have the means to compound, cast, and grind lenses and mirrors that permit us to peer farther than ever before into matter and into space. We command the strength of engines whose ratio of power to weight is constantly being increased. We have machines to produce millions of glass tubes whose miraculous contents harness a stream of electrons to our service.

A notable feature of the steplike pattern of material progress is that it has proceeded at a geometric rate. Each successive age has been shorter than the one before it. The Stone age lasted several hundred thousand years; the Bronze age, 4000 years; the Iron age, 2500 years. Steel was first made in commercial quantities 95 years ago; and the past 20 years have seen material developments that are almost incredible. It is as though the stairway of advancement were composed of steps with progressively higher risers and narrower treads.

Another outstanding feature in the history of material progress is that each step has been dependent on the one before it. The use of the materials available in one period—and I emphasize that word "use"—has supported societies in which men could accumulate knowledge. Such knowledge then made new quantities and new kinds of material available.

I emphasize the fact that people used the materials available in any period so that a fallacy one sometimes finds in connection with the conservation of natural resources will be crystal-clear. This fallacy is the concept of conservation as nonuse. I am convinced that nonuse results only in hobbling progress. It will not result in more natural resources for men to use but less, because it retards the march of scientific knowledge.

Now it goes without saying that I do not advocate reckless squandering of natural resources. What I do advocate is true conservation—which is not hoarding but efficient and intelligent use.

Our Inexhaustible Resources

2 Increasing knowledge operates in a number of ways to expand the natural resources available to us. It helps us to discover new sources of materials which we are already using and in the raw form that is currently useful to us. For example, new techniques like the use of the airborne magnetometer help us to locate oil fields. New knowledge also enables us to extract a material we are already using from raw forms which we were previously unable to process, such as iron from taconite. It also extends supplies of the familiar materials by developing more efficient methods of use. Improved heating units, turbines, and internal-combustion engines are cases in point here. More knowledge helps us work out means of using materials which have been known but not usable—as, for example, titanium. And it discovers or makes entirely new materials that do not exist in nature, such as plastics.

I'd like to enlarge a bit on these examples and their significance. Take petroleum.

A great many new sources of oil have been discovered in just the past several years. To mention only a few, there are the Williston basin in North Dakota, the Uinta basin in Utah, and

the Alberta fields in Canada, the Scurry and Spraberry fields in Texas, in addition to fields in central Sumatra, southern Iraq, and the Cretaceous fields of western Venezuela. In some of these areas, geologic explorations had gone on for years without any oil ever having been found before. In others, oil had been produced before, production had subsequently fallen off, then new horizons were tapped.

Our Inexhaustible Resources

By producing and using oil we have built a dynamic oil industry and have developed the means, both financial and technical, to find more oil. We have invented methods for locating and mapping structures with greater speed and accuracy. We can select where to drill a structure with better odds of success. We can reach deeper strata. As a result, in the United States alone, there has been produced since 1938 as much oil as was known to exist in the country at that time. And despite that great withdrawal, the domestic industry's proved reserves are at an all-time high level. It's as though we started out with a tank of oil, used it all up, and had a bigger tankful left. The wisdom of optimistic men in our profession, like Wallace Pratt, is becoming daily more evident.

Besides learning more about finding underground reservoirs of crude, oilmen are also learning how to get more of the oil out of the reservoir after it has been located. We are discovering how to get maximum yield from large, highly porous reservoirs of the Middle East type, where the water table is important, as we are also learning how to get maximum yield from tricky, tight reservoirs. Repressuring, waterflooding, and other techniques of secondary recovery are also adding greatly to the quantities of oil available for people's use. The supply of usable oil is increased also by improved practices in its transport and handling, which cut down losses.

New developments in the science of refining make possible

better products. This fact, coupled with improvements in consuming devices, means that we can get more work from a barrel of oil today than we could previously. And I think we've only begun to use the energy potential in a barrel of oil.

Our Inexhaustible Resources

Not only are we finding new sources of liquid hydrocarbons in the familiar raw form of crude petroleum; we will be able, when and if it ever becomes necessary, to derive liquid hydrocarbons from oil shales, tar sands, coal, and other sources not used at present.

Finally, our present use of oil and coal supports an industrial and scientific structure in which men are already learning how to apply atomic power to constructive work and may learn how to harness solar energy. Such developments, of course, would probably displace the fossil fuels in some applications, thus making them available for other use. The over-all effect would be to increase still more the total amount of energy available to humanity.

Incidentally, in connection with atomic energy, two news items which I recently noticed have a bearing on our subject.

Only a few months ago it appeared that the future use of atomic energy for industrial purposes might be doubtful because of the problem of the radioactive wastes. Yet only a few weeks ago, a government official reported that the solution is in sight. What he called "atomic garbage" is apparently on the verge of being employed in such a way as to be not just harmless but actually useful.

The second story was about a new atomic plant, called a "breeder reactor," now in operation. As I understand it, the object of the process is to use uranium 235, which is rare and costly, to convert nonfissionable materials, which are abundant and cheap, into fissionable material at a faster rate than the uranium 235 itself is consumed. One of these nonfissionable

materials is thorium, which previously was used chiefly in the manufacture of mantles for gaslights.

Our Inexhaustible Resources

3 I have been considering mineral energy resources. Now let us look at the picture for metals. There are 45 metallic elements and some 8000 alloys of those metals now in commercial use.

The world in general, and the United States in particular, is using metals at a rate never seen before. Two world wars in a quarter century and the present unhappy need to build great quantities of arms have used vast amounts of iron and copper—to name but two metals in demand. Our steel expansion program now under way calls for annual production of 120 million tons—15 million tons more than we turned out last year. And, to meet our new needs, we plan to step up our domestic production of copper (which last year was about 1.2 million tons) by 225,000 tons, and aluminum by 700,000 tons.

Can we say that what has proved true of fuels will prove true of metals? We have seen that increased knowledge has led to the discovery of new sources of energy which are seemingly unlimited. Does a comparable outcome seem likely with respect to metals?

The metals we use most—iron and aluminum—are second only to the elements of oxygen and silicon in their abundance on our planet. It has been estimated that there is at least 5000 times as much iron ore, bauxite, and alunite in the earth's crust as the world now uses annually. Furthermore, unlike fossil fuels, most metals can be reclaimed after use and used again. In the meantime, the discovery of new sources of metal supplies and the development of techniques for making them economically available go on at a rapid pace.

It wasn't so long ago that people were worrying about imminent depletion of the 50 per cent iron-ore deposits of the Mesabi

range. Today a number of steel companies are planning or building facilities, estimated to cost over three-quarters of a billion dollars, for processing taconite. Taconite deposits in Minnesota occur in a hundred-mile strip, several miles broad, and are believed to amount to 5 billion tons. The reducing plants will turn out about 1 ton of 60 per cent iron from every 4 tons of taconite.

Our Inexhaustible Resources

Rich deposits of iron ore have been found in a number of countries outside the United States and are now being developed, in many cases by American capital. Labrador, Venezuela, and Brazil, for example, are the scenes of some truly epic engineering projects. A 358-mile railroad is being cut through wilderness and wasteland to haul ore from the Ungava area in Labrador to water. At Steep Rock Lake, Ontario, 70 million tons of a lake bed are being removed in a four-year dredging operation to get at an iron deposit underneath. In El Pao, Venezuela, one of two projects in that country has been completed after fourteen years of work. Ore has to be shipped by a railroad built through jungles, and by barge to the sea on a river whose water level at the loading point fluctuates 43 feet at different seasons.

Our Inexhaustible Resources

We take aluminum for granted these days. It costs currently about 18 cents a pound. Yet when the Civil War started, it sold for $545 a pound. United States production now amounts to about 800,000 tons per year, and plants under construction will almost double that figure. If it becomes necessary to find substitutes for bauxite or alunite ores, chemists seem confident they will be able to produce aluminum oxide from aluminum-bearing clays.

The first plant to extract magnesium from sea water went into operation only eleven years ago with a capacity of 9000 tons a year. Magnesium production in the United States for 1952 is expected to exceed 100,000 tons. As for the future—there's a lot of water in the sea.

Titanium is one of our most abundant metals and has long been known. What we have not known is how to extract it from the earth's crust at a cost which would make it economic for large-scale use. Up to five years ago, titanium was used chiefly as an ingredient in paint. But it is lighter than steel, stronger than aluminum, and highly heat-resistant—hence potentially very useful. Present extraction processes are still expensive, but I have heard that a more economical method is being developed.

With almost every metal the story is repeated—of widening use, of the discovery of new sources and better methods of extraction. Here, as in other fields, research and ingenuity have been great multipliers of our natural resources.

Our supply of metals is being supplemented by other rigid materials—both old ones put to new uses and newly discovered ones. Glass, for example, is an ancient product that has been improved in recent years to the point where it can take the place of many other substances. And it is made of materials whose supply is practically unlimited.

As for plastics—mere infants in comparison with Granddaddy Glass—there seems no limit to the possibilities of synthesizing

organic compounds. A hint of some of the things to come may have been contained in a story I read only a month ago of an automobile body made of plastic and layers of glass fiber. It was claimed the body is dentproof, rustproof, and, for its weight, stronger than steel. When you consider the large fraction of our steel output that goes into auto bodies you can perhaps imagine what a successful plastic body would mean in terms of metal supply. That's especially impressive when you consider further that plastics can be made from corncobs, oat hulls, the spent fibers of sugar cane, and other materials we used to regard as waste.

Our Inexhaustible Resources

These benefits are available to us as they become economically feasible, in that orderly natural development characteristic of all true technical progress. We discovered long ago that the real usefulness of any new product or process begins only when its economy in use surpasses the economy of that which it is supposed to replace. We could, for example, grow bananas at the North Pole, but the usefulness of such a project is clouded by considerable doubt.

For many years, I believe, people have tended to think of natural resources as so many stacks of raw material piled up in a storehouse. A person with this sort of picture in his mind logically assumes that the more you use of any natural resource, the sooner you get to the bottom of the pile. Now I think we are beginning to discover that the idea of a storehouse—or, at least, a single-room storehouse—does not correspond with reality. Instead, the fact seems to be that the first storehouse in which man found himself was only one of a series. As he used up what was piled in that first room, he found he could fashion a key to open a door into a much larger room. And as he used the contents of this larger room, he discovered there was another

room beyond, larger still. The room in which we stand at the middle of the twentieth century is so vast that its walls are beyond sight. Yet it is probably still quite near the beginning of the whole series of storehouses. It is not inconceivable that the entire globe—earth, ocean, and air—represents raw material for mankind to utilize with more and more ingenuity and skill.

Our Inexhaustible Resources

This conception of limitless raw material is not new. It is held by a number of persons. But it is an idea certainly not familiar to people at large. I notice, though, that Dr. Lahee's recent American Petroleum Institute report is receiving wide publication. It's the one that shows that for every barrel of crude oil or cubic foot of natural gas withdrawn from the ground in 1951, two new barrels of oil or cubic feet of gas were found or developed. Perhaps the idea is getting around.

I should like to point out a corollary to this thesis. It is that the concept of unlimited raw materials does not mean that progress is simple and that Utopia is at hand. On the contrary, raw materials, no matter how vast in amount, do not become available resources until human thought and effort are applied to them. In a very real sense raw materials do not exist, they are created. We know, for example, that in a region of great mineral wealth, people can grind out their lives in poverty and misery if they do not realize the wealth exists or if they do not know how to get at it. It is use that makes it valuable. Even when the wealth is made available through technical means, the accelerating growth of populations and the enormous wastage of war are additional complications to consider.

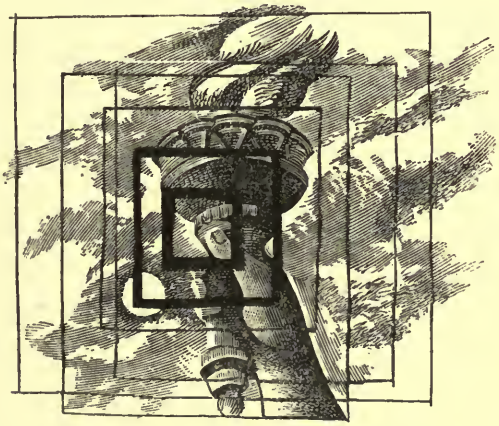
So the march up the steps of material progress, or from storehouse to storehouse—according to which figure of speech you prefer—depends not alone on the continued expansion of scientific knowledge and on industrial daring and managerial skill, but also on political and social conditions. Those conditions in

many parts of the world today are not conducive to progress. In fact, extreme nationalism, government controls and monopolies, currency restrictions, abnormal tariffs, threats of expropriation, wars and revolutions, have sealed the doors to many storehouses of useful raw materials.

Our Inexhaustible Resources

The basic requirement for progress is freedom—freedom to inquire, to think, to communicate, to venture. Without these conditions, the human mind and spirit will be so shackled that the availability of natural resources will be limited and we may exhaust the known sources of some needed material and find nothing to replace it. To the free man, all things are possible. Opportunity is the wand which can change the useless into the useful, waste into raw materials of great value, exhaustible resources into inexhaustible resources. It is the key that unlocks the greatest energy source of all—the infinite power of the human individual.

The longer I live, the more convinced I am that material progress is not only valueless without spiritual progress: it is, in the long term, impossible.



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RECENT DEVELOPMENTS

IN

THE ADMINISTRATION OF THE O. & C. LANDS

W. H. Horning
Chief Forester
O. & C. Administration

Portland, Oregon
December 14, 1939

My statement this year is somewhat in the nature of a progress report concerning the administration of the O. and C. lands since the last time I appeared before you. Some of the activities were foreseen at this time last year and mention of them was made at that time. Others were unforeseen and among them are several which appear to merit discussion before this organization which played a part in preparing the way for the conservation program being applied to these lands.

A New Plan for the making of Payments in lieu of Taxes on Federal Forest Land.

One of the unforeseen tasks at this time last year was a special appraisal job applying to the Coos Bay Wagon Road grant lands which are located in Coos County and Douglas County. This work was necessitated by the enactment of legislation establishing an entirely new procedure to be followed in the making of payments in lieu of taxes on this portion of the land administered by us. This legislation has the following provisions:

1. That the valuation shall be appraised at intervals not exceeding 10 years.

2. That these appraised values shall be used by the counties for the purpose of assessing and levying taxes at exactly the same rate as on lands of similar character in private ownership.

3. 25% of the gross income is to be earmarked and retained by the Federal Government to cover the costs of administration. The remaining 75% is to be deposited in a special trust fund.

4. Payments in lieu of taxes shall be made from the above-mentioned trust fund and any surplus beyond the requirements for payments in any particular year will remain and accumulate in the trust fund until the end of the 10-year period. Any surplus remaining at the end of that time is to be cleared and deposited in the general fund of the United States Treasury. The expectation is that the trust fund arrangement will serve to level out the effects of fluctuations in timber sale income and permit a regular flow of payments in lieu of taxes to the counties.

This particular piece of legislation is of special interest due to the fact that Congress has gone much further than previously in recognizing an obligation to pay taxes to lesser governmental units, upon property owned by the Federal Government.

A Land Exchange Policy

Another piece of legislation was passed which affects the management program on the O. & C. and Coos Bay lands. This legislation broadens the authority for making land exchanges to permit exchanges with counties and certain other public agencies. The authority to make land exchanges is expected to serve as a very useful tool in bringing about a more rational distribution of land ownership, especially in connection with the establishment of local sustained-yield management units. This same authority carries the possibility of endangering certain of the major objectives of management which are stated in the legislation of 1937. The principal danger foreseen is that the indiscriminate making of exchanges could result in concentrating privately-owned timber in the more easily accessible and more valuable merchantable stands of timber with a concentration of the O. and C. holdings in the less accessible and less valuable stands. This might easily result in stimulating the liquidation of private timber and the speedy exhaustion of the timber in areas tributary to important communities.

One of the principal objectives of the 1937 legislation is to provide a form of management which will contribute to the economic stability of established industries and their dependent communities. This desirable conservation objective might be seriously deferred or completely defeated by indiscriminate land exchanges. Other undesirable consequences such as the development of temporary communities destined to deteriorate into ghost towns; unnecessary flooding of timber markets, etc. can be foreseen from lack of a definite plan in making land exchanges.

In view of the obvious need for a plan and policy to serve as a guide in making land exchanges, the following land exchange policy statement was adopted by the O. and C. Advisory Committee:

> "It is believed desirable to accomplish the early subdivision of the O. & C. lands into units suitable for the local application of sustained-yield management. In the establishment of all such units one of the principal purposes should be to contribute to the economic stability of local communities by providing an assured supply of commercial timber for the permanent operation of industries located in those communities.
>
> "Exchanges of O. and C. and Coos Bay Wagon Road lands should in general be made only after the definite locations of areas have been decided upon where the conditions are favorable for the establishment of sustained yield management units. The lands and timber to be acquired by exchange should be of such a character and so located that their acquisition will further the establishment of sustained yield units. Lands and timber disposed of by exchange should be so located that their transfer to private ownership will result in the least possible interference with the establishment of sustained yield management."

Grazing

Most of the preliminary work on the formulation of grazing regulations to be used on the O. and C. lands has been completed. In the near future these regulations in their present tentative form will be presented before groups of representative stock men to be studied jointly with them for the purpose of obtaining the benefit of their best judgment concerning important details affecting the conservation and improvement of the range values on the O. and C. lands.

During the year a few temporary grazing leases were made on lands located outside national forest boundaries. Grazing lands located inside national forest boundaries have been handled under a cooperative understanding with the U. S. Forest Service, which organization is in position to administer the grazing on the lands which are checkerboarded with national forests. Under this arrangement, a share of the grazing revenue is payable to the O. and C. Administration, this share being in proportion to the acreage of O. and C. grazing lands within the units administered by the Forest Service.

Reclassification Survey

At this time last year a land classification survey staff was in the process of being recruited. The work of classifying the O. and C. lands to determine the uses for which they are best suited has gone forward and covers a substantial acreage. Most of the lands covered were formerly in the agricultural classification which was based upon an arbitrary standard requiring lands with less than 300,000 board feet of commercial timber per 40-acre tract to be classified as agricultural in character. Most of these lands are found to be best suited for timber-growing and have on them extensive stands of young, thrifty timber which is making a good regrowth. Growth studies are being made in all such immature timber, and the data being collected will be of great importance in determining more accurately the sustained yield capacity of the O. and C. lands. The collection of this data is being done in accordance with standards comparable with those followed in the general forest inventory work of this region in order that it may be coordinated with and used to supplement the information already collected and available for use. The following data indicate the progress made thus far in the classification survey:

136,000 acres in former agricultural classification surveyed and reclassified.
36,000 acres intensively cruised and classified in locations where timber sales are active.

172,000 acres - Total area resurveyed.

The acreage found suitable for agricultural cultivation is negligible. A high percentage of the former so-called agricultural lands bears good second growth and a considerable portion bears merchantable timber.

CCC Accomplishments

During the past year, two additional CCC camps were established on the O. and C. lands, thus bringing the total number of camps up to five. The activities of these camps are concentrated chiefly on the following classes of activities: The construction of truck trails; fire suppression; construction of forest protection structures such as lookout towers, guard stations, and telephone lines; and reforestation.

The following statistical details are of some interest in showing the accomplishments of the past year:

Project	Amount	CCC Man-days	Material and Supervisory Costs
Fire fighting	127	25,170	$ 18,615.45
Truck trail construction and maintenance	259.8 miles	88,127	85,957.45
Telephone line construction	49.2 miles	3,123	1,252.40
Vehicle bridges	10 bridges	1,762	2,029.97
Forest nursery	1 (500,000 (annual capacity)	2,296	3,797.84
Lookout towers & guard stations	2	1,075	677.17
Roadside fire hazard reduction	58.4 miles	18,421	9,513.02
Snag falling	1,021 acres	2,485	1,439.91
All other jobs		9,601	
Total - - - - - - - - - - - - - - - - - -		152,060	$123,283.21

(Spent by O. and C. Administration CCC)

The costs given above include pay of supervisory personnel, gasoline and oil, equipment repair, supplies and materials and other expenses incidental to the work job. The costs shown do not include general CCC expenses, but only that amount allotted to and spent by the O. and C. Administration for camp operation. The total cost to the government for each CCC enrollee amounts to approximately $82.00 per month, which includes all expenses chargeable to CCC.

The truck trail construction program had included the building of a number of miles of truck trail to penetrate the Smith River burn as a necessary improvement for protection purposes. This has resulted in the starting of salvage operations on a substantial scale in the fire killed timber.

The total of 152,060 man-days, or 7,012 man-months, used on forest protection and improvement work by the GLO-CCC camps indicates that the Federal Government has expended $574,984 through the O. and C. Administration for the benefit of the Oregon forests.

Approximately 400,000 nursery-grown seedlings were used last spring in the reforestation of denuded forest land. In excess of half a million are in readiness for reforestation work this winter.

Timber Sales Practice

It has been the policy to restrict sales of timber to the minimum possible without hardship to established operators, in the areas where the timber is predominantly of the so-called second-growth class and still making active growth. Sales are encouraged in areas where the timber is predominantly over-mature. There has been increasing emphasis on selective cutting and in general the loggers have given ready cooperation in trying out such practices. The type of selective cutting used varies considerably with the character of the timber, topography and other factors. The following types of selective cutting are on trial.

1. Economic selective cutting of high-value trees in old over-mature stands. The results of such cutting generally look good but there remains a slash-disposal problem which is a matter of serious concern. No plan for the disposal of slash in these selectively-cut areas has been developed to a point where it is entirely satisfactory and generally acceptable. Certain loggers have had a good degree of success in partial burning of slash in such areas, restricting the fire to those spots where the slash accumulations lie heaviest. Through the use of CCC labor, experimental work on several different plans for disposal of slash on such areas will be carried out during the coming year for the purpose of determining, if possible, some satisfactory plan which can be readily carried out by the average operator at reasonable cost. We are hopeful that this can be worked out and made a matter of general practice.

2. Selective cutting based upon the setting of a minimum diameter limit has been tried out and found to be successful under certain conditions, but unsuccessful elsewhere. In Douglas fir, this plan can be counted upon to produce successful results only where there has been a careful preliminary examination of the timber stand for the purpose of determining the distribution of the smaller-diameter trees. In certain localities such trees are located in large groups, or small areas, and under such conditions the setting of a diameter limit results in a desirable form of area selection. This plan has worked out better and with less difficulty in certain portions of the pine area, but even there, the conditions and distribution of the timber stand requires study in advance of selling the timber.

3. Area selection. The plan of selective cutting by areas has been tried out sufficiently to indicate that it can be applied successfully. Usually the type boundaries between areas of mature timber which should be removed and areas of less mature timber which should be reserved do not follow survey lines. In laying out cutting boundaries between such areas, it is usually found necessary to make 100% cruises of timber on fractional 40s.

4. Selection, based upon the marking of trees selected for cutting, and 100% cruising. This plan is restricted mainly to the pine areas and to areas where Port Orford cedar is important.

All of these selective cutting practices necessitate some modification of the old practice of broadcast burning of slash. In the pine areas, the slash is piled and burned in strips along both sides of roads and along the outer boundaries of cutting areas. Snags are felled in strips of similar location. In the Douglas fir stands, slash disposal is taking the form of burning out the spots of heaviest slash accumulations and preventing fire on the intervening portions of the area on which are located reserve timber and patches of young growth.

Increasing attention is being given to the matter of forest practice reconnaissance preliminary to advertising and selling timber. This has been found necessary in order to determine more accurately the special provisions in cutting contracts required to protect the young timber, especially in areas where varying age classes of timber meet or overlap.

The following example showing an area for which a timber sale application has been received serves as an example of the changes in practice resulting from the above mentioned forest practice reconnaissance.

The area shown as type 9 is covered with young Douglas fir 6" to 20" D.B.H. but has scattered through it some high value trees of Port Orford cedar and old growth Douglas fir. Only the mature trees in this portion of the area will be removed. Caterpillar tractors will be used and maximum protection given to the young timber.

The area shown as type 18 consists, in the main, of mature Port Orford cedar exceeding 30" D.B.H. and old growth Douglas fir exceeding 44" D.B.H. This portion of the area will be practically clear cut excepting for the leaving of trees smaller than the above diameters which will be reserved as seed trees.

The area shown as type 8 is covered in the main with young fir 26" to 42" D.B.H. with an understory of young Port Orford cedar, and scattered through its margin some mature old growth fir and Port Orford cedar. The only logging permitted in this portion of the area covered by this type will be for the selective removal of the scattered mature trees.

After logging is completed the district ranger, in cooperation with the local fire warden and the logger, will examine the slash and together they will make plans for its careful disposal in a manner appropriate for the protection of the residual stand.

In the old days, no such care or control of cutting and slash disposal were exercised. The logger would have taken all he could and unrestricted broadcast burning of slash would have killed practically all of the remaining trees.

The field men of the O. and C. organization have been working in close cooperation with the lumbermen, the state inspectors, and district fire wardens for the purpose of planning the conduct of slash disposal work. It is altogether possible that the results have not been 100% perfect in all cases but in general the fire hazard in logging slash is believed to have been adequately reduced, and at the same time, much more young growth than formerly is being saved for earlier reestablishment of the forest on cutover areas. The silvicultural practices are necessarily those which can be carried out by the logger in calked boots.

Volume of timber sales and Timber cut.

Timber sales at this time last year were at a low ebb but have increased rapidly since that time. Our increased field personnel for the conduct of timber cruising and the supervision of cutting have served to release the jam which had been blocking the normal flow of timber business.

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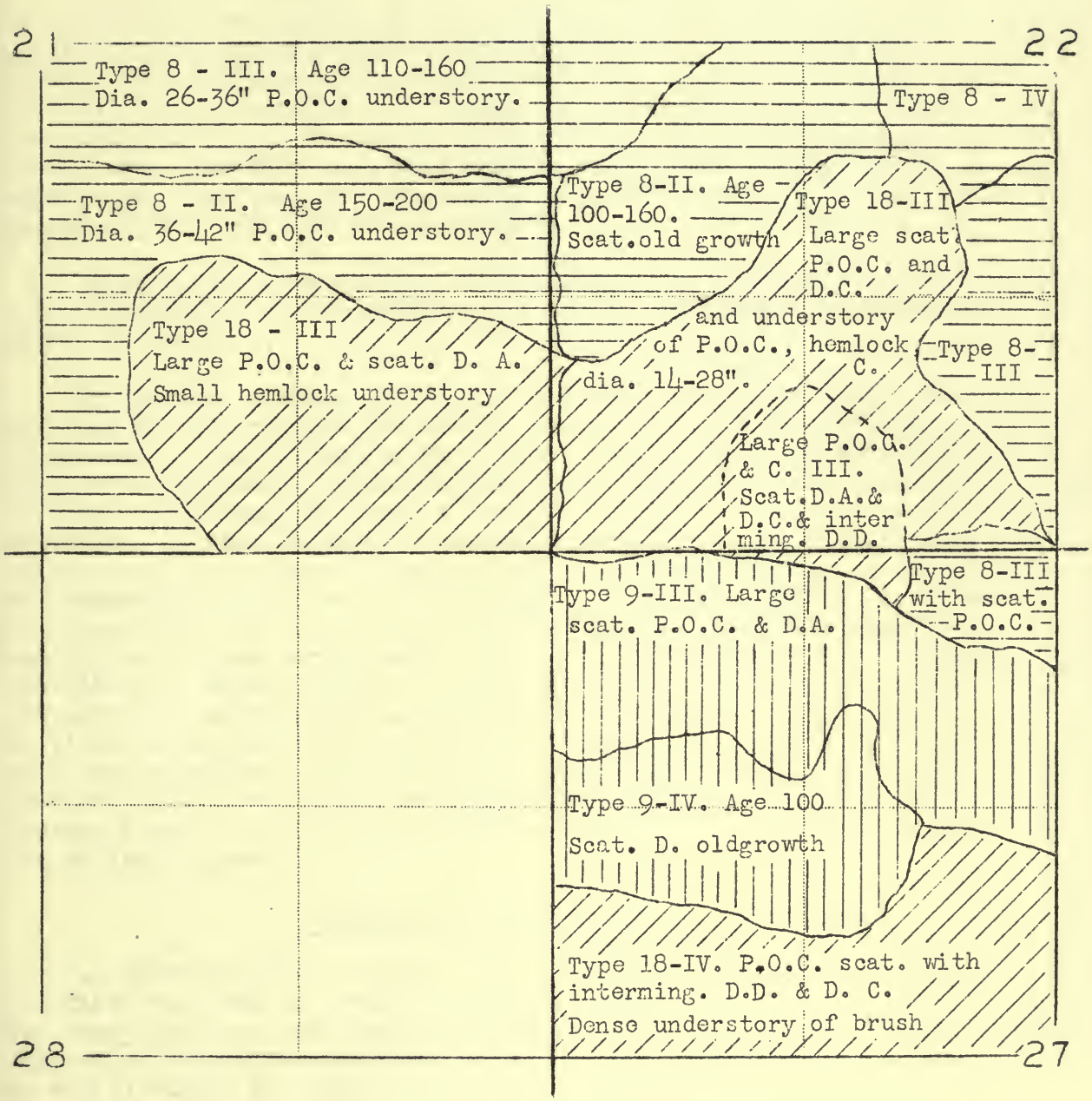
FOREST PRACTICE RECONNAISSANCE SKETCH



In consequence, the flow has been constantly rising since early last spring. At times the volume of sales has exceeded the average required to attain our sustained-yield volume of 500,000,000 board feet per year. Owing to the fact that certain larger sales run for periods of years ahead of cutting, the volume of sales is not a reliable measure of the rate of cutting. Receipts of money, owing to the fact that the timber is paid for as cut, serve as a more reliable indication of the cutting rate and permit an approximate determination of its volume. Field reports concerning the progress of cutting permit an even more exact determination.

The volume of timber cut per month, which was averaging 11,000,000 board feet in the first quarter of the year, has risen consistently and in the last quarter of the year has averaged 32,000,000 board feet. The average rate of cutting for the first half of the fiscal year, beginning July 1, 1939, has been 28,000,000 board feet per month. This rate if continued undiminished for the remainder of the fiscal year will result in the cutting of 340,000,000 board feet. Probably much more will be cut because a large volume has been sold in which cutting has only begun. The total volume of timber sold since October 1938 is 600,000,000 board feet.

These figures are quoted for the purpose of pointing out their significance in relation to the problem of attaining a regulated timber cut on the O. and C. lands.

The law under which the O. and C. lands are managed authorizes their handling as one unit, pending their subdivision into cooperative sustained-yield units, established for the purpose of providing a sustained-yield of timber for particular industries and their dependent communities. The handling of such a far-flung property as one unit, however, may result in too rapid depletion, or even exhaustion, of the timber in certain localities. To the extent that this occurred, the objective of economic stability for industries and communities would be more difficult, or perhaps impossible, to attain. This points to the obvious need for a measure of localized regulation of timber-cutting during the period while local management units are being studied and established. Having reached a level of timber sales closely approaching the allowable sustained yield cut of 500,000,000 board feet per annum permits our fulfillment of fiscal obligations to the land grant counties, and at the same time the undertaking of measures to regulate and curtail the cutting of timber in those localities where over-cutting of timber is occurring, and for the further purpose of obtaining a better distribution of cutting generally over the entire property.

Planning for Regulation of Timber Cutting

In attempting to deal with this problem of regulating the timber cut, our first step was to determine whether cutting exceeded the allowable volume. For study purposes, the area in which the O. and C. lands are located has been subdivided into eleven relatively large economic units. The total volume of O. and C. timber in each unit has been ascertained. The allowable cut for each unit has been computed roughly in proportion to the merchantable timber in each unit. The actual volume of timber cut in each unit last year having been determined, was then compared with the allowable cut. The results of this study show in general that cutting last year exceeded the allowable volume in the territory north of Land County, and was far below the allowable volume in the territory farther south. In three units, the timber cut was seriously in excess of the allowable volume; in two units, the allowable volume and actual cut were approximately in balance. In the remaining six units, the actual volume cut was only a fraction of the allowable volume. The

total volume of timber cut last year was far below the sustained-yield of 500,000,000 board feet, but for the present fiscal year, it promises to closely approach that limit. The preceding statements, however, indicate that the distribution of the cut is seriously out of balance in certain areas and probably becoming more out of balance as time goes on.

Having established these facts, the next questions are what should be done to improve the situation and how shall we proceed to accomplish this improvement? Obviously, the timber cut should be gradually reduced in those districts where it exceeds the allowable sustained-yield and expanded in those districts where the great surplus of over-mature timber exists.

In accomplishing the necessary reductions in cutting, every effort will be made to give due consideration to already established industries and their dependent communities. In doing this it will be necessary to classify the existing lumbering operations and to assign priority ratings to them which will result in allocating the available timber in the most equitable manner and according to a plan which will be consistent with proper conservation of the resources involved. In general, in making these priority ratings, it is believed that the following factors should be carefully considered and weighed:

1. Refinements in manufacture which result in a high ratio of employment to raw material.

2. The degree of dependence of each operation upon O. and C. timber for permanency of operation.

3. The degree of efficiency in practicing close utilization of timber both in the woods and in the manufacturing plant.

4. The degree of compliance with the approved forestry practices of the region.

5. The ability and willingness of the operator to develop and apply on both the public and private lands forest practices which will be in harmony with the requirements for local application of sustained yield management.

6. The distance of the manufacturing plant from the timber supply. (This point is important as a factor in conservation because mills located close to the timber in general can make profitable use of lower grades of logs than can more distant mills, consequently, mills located near the timber are in position to practice closer utilization of trees as they cut them.)

7 The ability and skill in practicing selective or partial cutting.

8. Demonstrated ability to apply those slash disposal practices which result in saving a substantial proportion of the seed trees, young timber, and reproduction found on logging areas.

The problem of devising a suitable procedure to use in regulating timber cutting and in bringing it within the proper limitations of sustained-yield, has received sufficient preliminary study to permit the formulation of

definite proposals for consideration by the O. and C. Advisory Committee. In the near future these proposals will be placed before representatives of the principal local and state interests, both public and private, whose welfare is most intimately related to forest conservation. They will be afforded an opportunity to study the proposed plan and to contribute suggestions for its improvement. The completion of this plan or code for the regulation of timber cutting and the initial stages of trying it out and adjusting it in practical application embraces what is probably the most important new work ahead of the O. and C. Administration during the ensuing year.

CRISIS SPOTS IN CONSERVATION

D. R. Fitzpatrick, St. Louis Post-Dispatch

Izaak Walton League of America, Inc.

THIS IS *Your* GUIDEBOOK!

Two years ago a group of covetous livestock operators launched a drive to secure millions of acres of our public estate in the West for a selected few stockmen. Nothing in recent history has so unified conservationists as did this "Great Land Grab" proposal. Rallying quickly and acting in concert, they killed the scheme. It was a victory outstanding in conservation annals.

Abandoning the land grab, the small livestock group referred to is now attacking the U. S. Forest Service with vitriolic vigor. One public lands battle was won, and won decisively. But the war, conservation pitted against exploitation, goes on—not only in this sector but in many, many others.

During the time we were all joined to block the "Land Grab," several truths emerged sharply etched. One was the demonstration of the power for good that rests in the hands of the conservation forces when those forces are adequately armed with fact and kept alerted through timely intelligence.

Another demonstrated truth became evident at the same time. It was that, while most national and large regional organizations performed outstandingly in keeping themselves and their memberships informed, many willing and earnest local groups and individuals did not have, and found it difficult to get, information they wanted and needed. Beyond that, while the current status of many critical situations might be reported swiftly to large numbers of interested individuals and organizations, many of those receiving warnings did not have at hand the background story, the history of the problems, the essence of the overhanging threats, on the basis of which they could move constructively. Lengthy correspondence, and concurrent delays, often hindered those who had a genuine wish to assist in assuring preservation and improvement of resources for the benefit of all the public.

Thus, when Bernard DeVoto said last spring that one great need of today was a "guidebook" to the crisis areas in the field of conservation of resources, we determined to try to supply the need. This booklet is the result.

The booklet is in no wise intended as a duplication of any of the excellent reporting services of a number of national organizations that keep so many people informed of current developments and changes. Instead, it is hoped it will serve as a reference, within arm's reach at any time, to give FOUNDATION FACTS as to what is involved in any given crisis area. For example, should the reporting service of any organization to which you belong or to which you have access, warn of impending action, or policy changes, giving necessarily brief facts about current developments, reference to this handbook will, it is hoped and believed, often supply immediately the background necessary to make your reaction swift and effective.

Much of the contents of this booklet has been gathered through what we may call the enthusiastic and certainly the generous cooperation of those upon whom we called for information. In responding, most of them repeatedly accented the need for a "hot spot" handbook. In putting the information together we have necessarily had to condense it sharply. And, we are sure that we have not been able at this time to include information on ALL the areas that deserve mention. After all, we had to consider limitations of time and of money available for this purpose, as well as limitations of our own admitted deficiencies in comprehension of all conservation problems. No one person can have complete grasp of every such existing problem.

Limitations cited have forced us to brief voluminous material received; much of it of high worth. Even though condensation has squeezed out valuable explanatory texts, such information has helped us to extract the essence of situations. When, therefore, terse, blunt statements are made, they are backed by this able, detailed, explanatory reporting by cooperators.

We have had to select what appeared to be the "hottest" spots. Where there are general, basic problems, we have tried to state the governing factors, supplemented by "case histories." Problems that are of state-wide or regional importance, vital ones, in many instances, can be met only by action of conservationists in the area. Where problems of regional rather than national magnitude are mentioned, we urge contact with leaders in the area.

In briefing, in general, we have followed this pattern:

1. **Historical background.**
2. **The nature and style of threat.**
3. **Present status of project or problem.**
4. **The constructive approach.**

We hope that in time, as further information is made available to us, and as conditions in this dynamic field change, we will be able to add to or modify the booklet sheets, as circumstances dictate. It also may be possible for us to supplement this information with occasional bulletins to further fortify reports that may be received from other sources, or to point up changes in status of matters found herein.

Fundamentally, we have hoped, in preparing and supplying this handbook, to provide you with source material, foundation facts on critical areas of conservation activity, all in one packet. It is a booklet you will want within reach at all times. It may be taken apart for filing if you wish, or may be placed in a ring binder in which additional or substitute sheets may be put.

In providing this, our goal is the filling of a demonstrated need, of placing in the hands of conservationists essential facts on as many crisis spots as we could assemble in the limited time we felt we had in which to get the job done. It is our earnest hope that the booklet will prove to be a real aid, to assist you in determining your appropriate course with speed and accuracy when emergency comes.

ARTHUR H. CARHART.

"CRISIS SPOTS IN CONSERVATION" has been reviewed by the undersigned, and is being published and distributed by the Izaak Walton League of America, Inc., as one more facility for the information of all groups and individuals interested in the appropriate utilization and conservation, in the public interest, of our country's renewable natural resources. We will welcome constructive criticism, as well as authenticated information on crisis spots not now covered.

WILLIAM VOIGT, JR.
Executive Director.

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THE GREAT LAND GRAB
Our Public Estate in the West

HISTORY — On Aug. 16-17, 1946, officials and certain individuals of the National Wool Growers and American National Livestock associations, meeting in Salt Lake City, Utah, formed the "Joint Livestock Committee on Public Lands," consisting of ten men. Four were cattlemen, four sheepmen, and two were growers of both.

The avowed purpose of the committee was preparing, securing introduction in Congress, and pressing for enactment of legislation to allow purchase of public lands in the West by those now privileged to run livestock on those lands. The price they were willing to pay was low; the interest on unpaid balances was low; the time allowed them to make up their minds to buy was long; the time thereafter for paying out was twice as long.

Some 146,000,000 acres of public domain administered under the Taylor Grazing Act of 1934 were directly involved in the initial objectives. In succeeding months various members and close associates of the Committee made it known in published statements and other actions that the ultimate goal was to include millions of choice acres in the National Forests, and even parts of National Parks and Monuments.

Under the initial plan important portions of middle elevation watershed lands would have been transferred to ownership and management of individuals. The way would have been open to a progressive padlocking of now public lands against the public. These lands also have wildlife, fishery and recreational values.

Under the elaborated plan the padlocking possibilities would have been still greater, the public values imperiled vastly larger. The meadow and valley lands near or along watercourses — natural gateways to the high back country — undoubtedly would have been the first taken from public ownership. Thus free ingress and egress to what public properties remained beyond the valleys would have been controlled by private ownership.

Public reaction against the proposals was so explosive that **bills which had been prepared** were **not** introduced in Congress. The so-called Barrett Subcommittee of the 80th Congress held packed and rigged hearings in the West in the fall of 1947, relative to grazing of our public properties. The style and conduct of those hearings were so lacking in fairness and dignity that they served mostly to arouse still further the opposition to the land grab plan.

About that time a shift in the strategy of the grasping few among the western stockmen became apparent. They scuttled away from the transfer scheme, at least for the time being. They began a concentrated attempt to undermine the U. S. Forest Service, which is charged with administering the National Forests segment of our national estate. This has been the "new" strategy ever since. It obviously was being used as recently as the 1949 convention of the American National Livestock association at North Platte, Neb., Jan. 11-13.

THE THREAT—Until recently we had been unable to get a straightforward statement from leaders of the stockmen as to the present status and future intentions of the Joint Committee and its sponsoring associations. Direct questions were evaded or ignored until Jan. 14, 1949. Then a letter from the executive secretary of the National Wool Growers said the Committe "as originally set up, can be considered disbanded." The letter said that a separate public lands committee was authorized by his organization. From this, and from what has been learned from other sources from time to time, it appears that for the time being, at least, the **joint** committee idea is out the window. BUT, so far as we have been able to learn, the livestock organizations have NOT repudiated either the Committee's recommendations or the widespread statements of other goals and objectives made by committee members and their friends, which included the broad-gauge, long-range acquisition of "Taylor," forest, park and monument lands. Therefore, we cannot conclude other than that this threat against our national heritage in the West still exists, and can be taken off the shelf any time the leaders believe they have a chance to jam it through Congress.

STATUS—While the land grab, as such, is dormant right now, controversy still goes on. The battle has merely been shifted from one place to another. Nowadays the stockmen leaders are pouring a constant and violent attack upon the Forest Service. There are several probable reasons for this maneuvering. One is that the Forest Service opposed the land grab deal. As conscientious guardians of our property it is hard to see how they could do otherwise. Thus, the present attack on the Forest Service seems to be a means of "punishing" those public servants who had the fortitude to stand up and say, "No!"

Another reason appears to be to discredit and weaken the Service to such a point that it cannot stand up against stockmen's demands for special privilege and immediate personal benefits. That sort of strategy worked with the old Grazing Service administering the millions of acres of Taylor lands; maybe it will work again.

Again, by raising such a stormy outcry against the Forest Service, maybe the public can be slickered into thinking that the question of how many head of stock may be grazed on the forests was and is the paramount issue; by kicking up a fuss in that quarter, public attention could be turned away from the facts as to the original land grab scheme which might then be advanced quietly.

The public lands issue isn't dead, even though the forces of conservation have been significantly victorious up to now. The pattern of action has merely changed from an immediate "grab" to a more devious formula or strategy.

WHAT NOW?—The "grab" as such has been beaten into temporary impotency. But until the two livestock associations involved disown the idea entirely and wash their hands of it, constant alertness must be maintained against it.

The immediate area of action is the attack on the Forest Service. We can well go along with the stockmen in saying the Forest Service is not a perfect agency. Name one that is! It has weaknesses that should and must be corrected, so far as humanly possible. But the weaknesses are weaknesses of detail, and do not alter our contention that the general pattern of administration by the Forest Service is good.

We must be on guard against efforts of the stockmen to "nibble" at Forest Service control, and efforts to have "legal status" given to the grazing of domestic stock on the National Forests. The objective is to try to make grazing a dominant use of the forests, and so designated by an act of Congress. Actually, under law, it is a secondary use, a privilege —just as is outdoor recreation on the Forests. Watershed protection and the orderly production and harvest of timber are the only uses actually named in the basic law.

HISTORY — The Act of March 3, 1891, provided for the establishment of National Forests; specified their purpose as perpetuation of timber supply and protection of watersheds. No other use was defined. The Forest Service, under this law, has a mandatory obligation to manage National Forests with the conservation of these resources paramount.

The Act of June 4, 1897, provides that other uses may be **permitted** when not incompatible with primary forest purposes of timber and watershed. Uses to be permitted not specified. Regulations issued June 30, 1897, **permitted** grazing of domestic livestock compatible with basic forest objectives. The **legal status** of grazing is thus fixed by the 1897 Act. Its position is that of a coincident use **allowable** if not damaging to legally-designated watershed and timber values.

In 1910, 7,648,950 sheep were permitted on the National Forests; 1,497,570 cattle. In 1917 the "bars were dropped" to allow a maximum of livestock on the forests as a war emergency action. In 1918, therefore, 8,572,208 sheep and 2,243,381 cattle were permitted on the forests. The ranges were grossly overloaded. Damage to watersheds and range resulted. Since that time, stockmen have opposed reductions in permitted livestock. Major reductions did occur during the depression. The 1947 figures show permits for 3,409,950 sheep, 1,246,626 cattle. Further reductions are needed **in some areas** to insure protection of watersheds and forage resources.

The Public Lands (Barrett) subcommittee demanded of the Secretary of Agriculture that no further reductions be made for three years. This was rejected. The then Secretary, Clinton Anderson, held "that some reductions are badly needed now to stop serious detrioriation on range land vital to local water supplies as well as to a stable livestock industry."

Thwarted in the "land grab" scheme, and rebuffed by the Department of Agriculture, parent of the Forest Service, a certain extreme group of livestock growers then turned on the Forest Service, its personnel and policies, as described earlier. They attacked the ability of our public servants to manage the forest properties, even attacked their personal integrity.

ASSAULT ON THE FOREST SERVICE

NATURE AND STYLE OF THREAT—The U.S.F.S. is accused of being arbitrary, incompetent, biased. Trained, able, experienced and trustworthy members of the Service have been copiously smeared. The parrot-like accusations in the "Barrett" hearings indicated the shift of the stockman clique from the "land grab" to this attempt so to undermine confidence in the Forest Service that its officials could be beaten into submission.

A flood of twisted and partial-fact propaganda is now appearing, even in supposedly reputable national publications, which emphasizes the "propaganda line" that by reducing livestock in the forests, the U.S.F.S. is a basic and major cause for the high cost of meat.

The facts are, that when the segment of livestock production resting on the National Forests is reduced to cold statistics, such absurd misrepresentations merely reveal the lengths to which these few enemies of conservation among the stockmen will go to discredit our public servants. Statistically, only 2/3 of 1% of total national beef cattle feeding days are secured from National Forest areas.

The leadership making this effort to smash down the U.S.F.S. is practically identical with that which was behind the "Great Land Grab." It is part of the same major battle of whether there shall be management of our western public estate to produce the highest combined values there, or whether a small group of livestock operators will impose their demands and establish a priority in their use.

The attack already has taken a number of forms, a few case histories of which will be given. The first and current phase is wide-spread misrepresentation to tear down confidence in the Forest Service. Unquestionably, if it appears that this has sufficiently succeeded, legislation then will be introduced to put stockmen in a position to define and direct management of our forests.

An expectable move would be a demand that Forest Service appropriations be cut in the name of "economy." At the same time the stockmen will scream that the U.S. F.S. hasn't reseeded any of the range. (Why should it have to be reseeded unless it has been overgrazed and, more than anything else, needs rest to recuperate?)

Another likely move will be to 'legalize' grazing. It has been pointed out that grazing already is "legal" under existing laws. It holds the same position as all forest uses other than watershed protection and timber production.

What the stockmen mean by "legalizing" grazing, is that by Congressional enactment it shall be given the position of a primary and dominant use. They want Congress to declare, now, that the forests established fifty years ago actually were created to serve grazing as a chief function. With the tiny segment of national livestock production actually resting on forest forage, they would place this above the natural resource values of other types in our forests—above timber, watershed, wildlife, recreation, all others. The basic threat is that a minor use, potentially damaging to other uses, a secondary use in fact, could be established by legislation as a dominant use to satisfy a few individuals.

THE CONSTRUCTIVE VIEWPOINT—Grazing is a legitimate use of the National Forests, but it can be allowed only to the extent that it will not injure primary forest purposes. The interests of many people and industries dependent on the timber, water, wildlife and recreation values we possess in these public properties must be considered, protected and well managed, and grazing must take its reasonable place in relation to other values and uses.

To countenance any attempt of a small group to secure for themselves a position of dictating management of the National Forests would be monstrous blows to sound conservation of natural resources. To permit this group to achieve that purpose through villifying, misrepresenting and emasculating the U. S. Forest Service is unthinkable.

This demanding group, only a small fraction of western stockmen, apparently influential beyond its actual numbers, can be thwarted only by everlasting national recognition of their intent, purposes, methods and nature. Meet their propaganda with truth. Watch any moves that may come when they consider the time opportune. The attack on the Forest Service is not an attack on a federal bureau as such. It is an attempt to smash a main defense of the concept of conservation itself.

THIS IS A MAJOR BATTLE WITH BASIC PRINCIPLES OF CONSERVATION AND OF DEMOCRACY INVOLVED.

THE UNCOMPAHGRE FOREST CASE

HISTORY — The National Forest lands on the Uncompahgre Plateau and adjacent areas in Southwestern Colorado have been one of the big battle grounds between some stockmen permittees and conservation (as represented by the U. S. Forest Service). The area is in a belt of low precipitation; forage is sparse in large portions of the range. Its history is one of heavy, often excessive, grazing by domestic stock.

In order to preserve the range itself as well as other forest values, the U. S. Forest Service, about a decade since, began a determined program of reducing numbers of livestock in this area. The immediate outcry by local forest grazers was terrific.

The same theme song has persisted ever since. This area's operators made up a large part of the audience at the "Barrett" hearing at Grand Junction, Colo., Sept., 1947, which was so fiercely censured in local newspapers, and by so many individuals. Much of that censure arose from yelling, whistling and other demonstrations whenever witnesses lashed at the Forest Service.

Regardless of the facts, this group continues to scream about being put out of business, about arbitrary action of the Forest Service, about wildlife ruining "'the stockmen's range," about anything which they can utilize in protesting their "suffering" under the hands of the "dictatorial" Forest Service.

As an illustration, a resolution was reported adopted by the Montrose County Board of Commissioners, and was printed in "The Delta County Independent," a newspaper of the Uncompahgre area, on Dec. 12, 1948. The resolution, a long one, "whereased" that "in the years from **1942 to 1948** inclusive the Forest Service and the Bureau of Land Management have annually diminished the use of these public lands by decreasing both the number of head of stock allowed to graze thereon, and by decreasing the seasonal period during which stock is allowed to graze," that "as a result . . . the number of stock grazed on said lands has . . . been reduced **from approximately 70,000 to approximately 55,000 as nearly as we can ascertain;**" that "this range land is in better condition that it has been for a number of years, and is in far better condition than stated by the reports of the Forest Service and of the Bureau of Land Management, that it has in the past supported, and is now capable of supporting, a far larger number of animals than presently is allowed to be grazed thereon by said agencies;" and that "this effect is the present **most serious threat to the prosperity and well being** not only of Montrose county but of the entire Western Slope of the State of Colorado."

Then it went on to resolve "That this board, in behalf of the residents and citizens of Montrose county, strongly condemns the policy of the Forest Service and the Bureau of Land Management as shown by its actions in **reducing** the grazing use of public lands in Montrose county;

"That this board recommends and most strongly urges **restoration of** all reductions in grazing use of public lands in Montrose county since the year 1942;

"That this board opposes and will continue to oppose, by all means within its power and authority, proposed future reductions in the grazing use of said public land;

"That this board believes that the conservation of land, including public land, is a means to an end and not an end in itself, and that **unbridled** restriction of the use of public land **in the name of conservation** is not only useless but a harmful, improper and **fascistic** invasion of the rights and of the economic security of the residents and citizens of Montrose county.

Signed:

NELS JACOBSEN,
CLYDE PORTER,
FRED SULLIVAN."

We hope that you have noticed the parts emphasized by us and will keep them in mind. Now let's look at the record!

Uncompahgre National Forest Grazing Permits in Hinsdale, Gunnison, Mesa and Montrose Counties

CATTLE

Year	No. Permitted	Animal Mos.
1942	18,898	106,083
1948	20,108	113,345

SHEEP

Year	No. Permitted	Animal Mos.
1942	37,177	108,399
1948	34,533	97,107

From 1942 to 1948, cattle actually increased about 10% in numbers and animal months on National Forest land. Sheep were reduced about 10% in actual animal months use. In both instances the change was progressive, moderate, in the direction indicated, year by year. This is not an "unbridled" or "fascistic invasion" of any "rights."

Turning to the record on the "Taylor" grazing lands, administered by the Bureau of Land Management, we encounter these data:

(There are two "grazing districts" in this area: Nos. 3 and 4).

On District 3 there were 171,654 sheep permitted in 1942; 119,490 in 1948. But with that numerical reduction longer seasons were allowed, and the "animal unit months," the true gauge of reduction, showed a reduction for sheep only from 68,988 to 65,840. Cattle grazed in this district in 1942 numbered 38,737; in 1948 they numbered 34,420. Animal unit months for cattle were reduced approximately 25%.

On District 4, 100,775 sheep were permitted in 1942; in 1948 there were 91,670. Cattle grazed in 1942 numbered 16,474, and in 1948 they numbered 17,691. There was a slight reduction in animal unit months, but the **number**, which was so emphasized in the resolution, was not reduced anywhere near the figures cited.

The inaccuracies of the resolution adopted by these county commissioners are self-evident.

THE NATURE AND STYLE OF THE THREAT—Here is an example of the type of mistruths, the enlisting of coerced or misled officials, voicing inaccurate declarations for the stockman clique to build up their "propaganda line." The charge of reductions, on the records, is untenable.

The state convention of county commissioners later adopted a resolution of this type.

This resolution is beautiful propaganda — for the stockman clique!

PRESENT STATUS—The status is clear. This is the sort of strategy those coveting our public estate in the West are following.

THE CONSTRUCTIVE APPROACH—Accept no such diatribe and blasting thing as this resolution at face value. Insist on proof. Then proclaim the truth.

The grazing situation in Montrose County is not a national conservation "hot spot" except as it illustrates moves to discredit sound management by federal administrators of public lands. It IS national in scope as it reveals the methods of those now attacking the Forest Service. It is clear warning as to what is building up by propaganda to emasculate the guardians of the western public lands. As a case history it is included so you may "see the wheels go 'round."

DAMMING, DRAINING, DIKING, DREDGING AND DIVERTING!

GENERAL — The second primary natural resource, co-equal with land in conservation plans and policies, is water. In the past, projects that have modified or changed almost completely, many natural water flows across the nation, have upset many existing values, created some new ones, have been successful, or have been failures or partially so, and have materially affected production of living things, one way or another.

But if conservationists have been disturbed in the past by plans of the engineering fraternity, they have reason to be somewhat panicky over what is now in prospect.

Examination of the records shows that to the date of June 30, 1947, $4,644,280,727 had been expended from federal funds in damming, draining, diking, dredging and diverting. At that time, a total cost of $5,337,392,580 was estimated for projects **then under construction.** As much was being poured into the accelerated water programs on that date as had been set up by the U. S. Congress and paid out for ALL projects then completed.

That is not all. Plans already **made** and awaiting presentation for approval by Congress, totaled $19,808,313,814. That means an anticipated, planned expenditure on projects under way **and** in the making to cost FIVE TIMES ALL PROJECTS PRIOR TO THAT DATE!

Nor is that all!

In the Aug. 6, 1948, Congressional Record, a report from the Chief of the Army Corps of Engineers disclosed that beyond the projects actually **planned** there is a tremendous block of projects which have been preliminarily investigated and are on their way toward the planning-and-approval stage.

Adding all project costs for operations **under way,** all **planned,** all **contemplated** projects in preliminary stages, the estimated cost totals FIFTY-TWO **BILLION** SEVEN HUNDRED TWENTY-TWO **MILLION** FIVE HUNDRED THOUSAND DOLLARS!

In terms of dollars, THERE IS OVER TEN TIMES AS GREAT A PROGRAM OF WATER "DEVELOPMENT" PROJECTED BY THE FEDERAL GOVERNMENT AS HAD BEEN COMPLETED BEFORE JUNE 30, 1947.

The two principal agencies concerned in these projects are the Army Corps of Engineers and the Bureau of Reclamation.

Growth in both agencies has been explosive in the last decade, in project plans, appropriations and in personnel. The Corps has 215 Army officers assigned to it—40,000 **civilian** employees make up the bulk of the staff.

The Bureau of Reclamation now has some 14,000 employees.

As a germain comment, on June 30, 1947, there were some 21,000,000 irrigated acres in 17 western states. But the 58 completed federal irrigation projects served only 5,000,000 acres out of this total. Reclamation estimates that there are potentially only 16,839,000 acres of lands not irrigated that may be added, at a very considerable cost, to those now under ditch in 17 western states.

The projects that can pay out on the basis of tilled acres put under ditch, the most feasible ones, were largely built years ago by private capital. In order to justify contemplated developments, all possible "benefits" have to be added up; even then, some are "non-reimbursable" values, big ones, which cannot be charged back against project costs—but must be paid for out of general tax funds.

The total tilled acreage of the nation is placed at 460,000,000. Much of that farm land has been damaged by poor land use practices. There is a basic question of whether more funds, as available, should not be applied to rehabilitation and perpetuation of fertility and production levels in **existing** crop areas, in **existing** established communities, **having** labor and transportation facilities, **nearer market centers.**

There is a question of how long dams built at great cost will impound adequate water above them to serve installations of canals and power machinery, because of excessive silting. This silting resulting from abused watersheds. Engineering estimates place the "span of life" of Lake Meade, above Hoover Dam, at from 55 to 125 years. Somewhere in that period, if silt goes into the lake at present rates, it will become a mud flat. Investment in the construction will be lost; communities below now served with water and power can become "ghost" areas. Engineers answer this question by saying they will build more dams above Hoover Dam to catch the silt—but there are only so many sites for such dams!

No little part of the disturbing situation we confront, is the competition between the Army Engineers and Reclamation Bureau to "get in there first" and stake their claims on various projects.

The impact of this hastily-assembled program, if it is fully carried out, will be terrific in many quarters. In the basic phase of financing alone, it will be terrific. That values will be created, there is no question. There is a question if we need them at the cost involved. There is a very grave question as to whether the investment will serve and produce over a sufficient length of time to "pay out." There are grave questions of what **existing values** will be **destroyed.**

What has happened to existing values in the past when engineering plans concerning water have been carried out will be picayune compared to what is in prospect.

There is no inclination whatever to obstruct or delay these water projects **if needed** and if the application of funds on them will be of more service to the nation than if applied in some other direction.

But there is so much in evidence, illustrated by the extreme and amazing project proposals of the engineers, when we examine projects they have proposed, that conservationists all over the nation will certainly question the whole program, and be deeply concerned.

The Bureau of Reclamation has 250 projects or units of projects in contemplation. Just how many the Army Engineers have lined up is a question; certainly a comparable number. It is apparent that not all can be discussed here.

It is our purpose, therefore, to give "case histories" which are admittedly those of high questionability, but which clearly indicate the extent and possible absurdity of the projects being whipped up for presentation to Congress or which already are examples of questionable projects that have been wholly or partially constructed.

On the basis of these examples, it can be seen how searchingly the whole program should be examined and weighed before it goes rushing toward completion and to results which may be somewhat uncertain.

There is no one segment of critical situations in the field of conservation more demanding of scrutiny and analysis than these mastodonic plans of our federal engineers!

THE MISSOURI RIVER BASIN

HISTORY—The area involved in this basin-wide adventure includes parts or all of nine states: Missouri, Kansas, Colorado, Nebraska, North and South Dakota, Montana, Wyoming and Iowa.

The Army Engineers, with an eye first on flood control and navigation, which are its civilian responsibilities, and Reclamation, with irrigation-power its principal concern, both began to put together plans for this watershed at about the same time. Each agency has specified responsibilities with regard to what shall be done by it, defined by Congress. Conflict developed. One agency criticized the other. Bitterness ensued.

When the public began to have dim realization of this situation, the Corps and Reclamation got together, began opposing a Missouri Valley Authority which would take over from watershed divide to river mouth. They agreed on which agency should "get" which projects, agreed that all projects of each agency on the Missouri would be "sacred cows," no criticism. The "wedding" gave birth to the Pick (Army)-Sloan (Relamation) plan for "development" of the Missouri basin.

The resulting plan, therefore, is a goulash of what the Army Engineers think should be done for flood control and navigation, and what Reclamation would like to do for irrigation. Both fatten on power production, and any other "benefits" that can be maneuvered into the plans to "justify" them.

Until very recently, the planning and developments under this hybrid plan have gone on without the most basic approach—the approach that could be supplied by Soil Conservation Service, Forest Service, and other divisions of the Department of Agriculture, by the Bureau of Land Management, National Park Service, Fish and Wildlife Service, and so on. As these agencies, which should determine what the needs **on the ground might be**, did come into the picture, they had to deal with plans already drawn, with the engineering outlook, without adequate regard for basic conservation, and in some cases these agencies finally invited in to cooperate, had to deal with projects already under way, nearing completion.

The conservation credo is that **all resources must be protected and developed from the top of the mountain to the sea, regardless of where appropriate responsibilities, skills, talent and knowledge may rest in our pattern of government.** With so little primary consideration of other factors, such as watershed involved, the Pick-Sloan plan must be grievously deficient in many respects; must have been set up on the engineering concept with conservation of many resources and other values, bud-grafted in as a later consideration—to meet the threat of a "valley authority."

The present estimate for the Missouri River "Pick-Sloan plan" is somewhere in the neighborhood of $6,300,000,000.

The plan was **approved** in Congress in 1944. That means it has clearance for the Army Engineers and Reclamation to go all out in setting up project units to be submitted for appropriations. The Department of Agriculture was not called in until 1948—after four years of engineering blue printing already had established what was intended in the way of construction.

THE NATURE AND STYLE OF THREAT—The real threat is that so much of this gigantic, engineer-conceived, plan may go into effect, the money spent, without essential and basic factors involving agriculture, forestry, land management and wildlife adequately worked out to fit into and substantiate the projects.

From most reliable sources, we have learned that there is insufficient hydrological data accumulated **to assure sufficient water to meet the projected demands of navigation, irrigation, power, flood control and all the other end results of the hybrid project if, as or when it is finished.**

That is an indication of the headlong plunging into actual construction, into big spending, that our country has undertaken without properly assembled and appraised basic factors. We have let our **action program get too far ahead of our fact finding.**

This is the disturbing picture of what is happening in the Missouri Basin; a SIX-BILLION-DOLLAR plan hurtling into actuality and end results are not clearly defined.

BUT, beyond that, there are OTHER basin projects, more billions involved, which also demand scrutiny. There are similar "basin" plans of these engineers for the Columbia, Colorado, Sacramento-San Jaoquin, Rio Grande, Rogue. Eastward, there are the majestic plannings for the White River of Arkansas and Missouri, the Arkansas basin in Arkansas, Oklahoma, Kansas and Colorado. And there are others—the proposal for a dam which will flood the Mammouth Cave National Park in such a way as to ruin much of its value.

PRESENT STATUS—The present administration in Washington is committed to an even faster and more aggressive completion of the Missouri River basin project. The whole works has already been authorized. It now is largely a matter of how fast the many millions in **appropriations** can be put through Congress to shove the construction along.

There is a growing questioning on the part of the public as to the feasibility of the gigantic proposals on this and other "basin" projects. There is real concern over the expenditures involved. An authoritative source has said that with a few exceptions, the governors of the states involved in the Missouri plan are upset over the proposals, would like to get away from supporting them, but can't because there still is a general impression that the building of dams, dams, dams, is "good," and politically they cannot "back out."

THE CONSTRUCTIVE APPROACH—First, above all things, there must be recognition that concrete, power plants and dredges should not be considered the primary end of planning water development; they are to serve the needs of soil and water, the basic values.

The dogma that all water projects are in themselves "good," must be abandoned. The case histories which follow should shatter that mirage which has been built up by propaganda.

We do not necessarily advocate an "authority" to assure the **inclusive** planning concept. It is one means of doing the job as it should be done—IF all factors and considerations are included. It COULD be done by existing agencies, but only if fully coordinated, with natural resource needs dominant in planning and development.

The fundamental thought is that we cannot go on without full coordination, however achieved; cannot go on with plans that are dominated by engineering concepts to the major exclusion of the natural factors which are basic to projects of this type.

The net situation calls for an insistent, demanding policy of preventing the nation from rushing headlong into the building of these projects until their functional, economic, social and all other considerations, are searchingly examined by qualified authorities other than the engineering forces.

While both of these are in construction-under-way status, they substantiate in detail some of the general statements about the hybrid Pick-Sloan plan.

THE COLORADO-BIG THOMPSON—Three particular points should be noted in this project, for they, or their counterparts in some degree, are present in others. These points are: 1. The "super-engineering" approach to water use problem; 2. The over-costs and increases; 3. The omnipotence in decreeing what happens to other natural resources.

Spectacular Engineering—This is one of the "clever" types of water juggling. Reclamation has put together a scheme which sucks the water out of the upper Colorado River, west of Rocky Mountain National Park, puts it through a 13-mile tunnel through the Continental Divide, runs it through a series of power plants on the Big Thompson river, channels it into foothill reservoirs, to irrigate an area near Fort Collins, Colo.—an area that already has well-established irrigation farming, all types.

In order to perform this "magic," the water in the Colorado river has to be trapped by the "Granby Dam," some 10 or 12 miles down stream from the west tunnel end, and pumped UP into a canal that winds around hillsides BACK TOWARD the Divide. The power to do the pumping is supplied from still another dam, at Green Mountain reservoir, 50 miles farther west on the Blue river.

This is an example of taking water from one water-shed to another. That it will do much good in developing lands around Fort Collins, Colo., is true. It might have done as much good if used within its natural watershed.

Ballooning Costs—This is a good example of what appears to be a policy of Reclamation, to get a project under way, then reveal that the estimated initial cost, advanced as the whole cost in the first place, is inadequate.

The original estimates of the Colorado-Big Thompson Diversion ran to about 44 million dollars. Current cost estimates exceed 140 million dollars. There has been recent squabbling as Reclamation has tried to get farmers who signed up to repay the original estimate, to revise their repayment contracts upward. A great rise in costs is involved.

Wildlife—The Colorado river below the Granby dam from which water is to be pumped back to flow through the trans-Divide tunnel, is one of the best 20 miles of fishing on that river.

TWO "CASES" OF MISSOURI BASIN PROGRAM

It also passes several communities. The project statement provides for a "live stream" to be maintained below the impounding-pumping point. But what is a live stream? A trickle between pools?

A recent thorough survey sets the existing fishing values in the 20-mile stretch at a minimum of $60,000 annually; that much is paid out by fishermen. This resource, the food in stream bed which supports it, the aesthetic value of the mountain river, all are in serious jeopardy.

BOYSEN RESERVOIR, WYOMING—This also is a project under construction. It is a most telling example of how the engineering mind thinks in terms of concrete dams down stream, while basic conservation needs up stream are ignored. Also, it is a sharply-delineated illustration of how disregard of the basic resources of water and soil progressively negates the concrete dam, causes loss of investment, ultimately wipes out one more dam site, and finally brings disaster to agriculture and other uses dependent on water impounded behind such a dam.

The Wind River comes out of a basin east of the Continental Divide, southeast of Yellowstone Park. After it flows beyond foothills of the main range, it takes on another name—the Big Horn.

Boysen Dam is on Big Horn river near the Montana line. The Wind-Big Horn drainage is a heavy silt-carrier. The silt derives 25% from "badlands," 25% from the waste water returned to the stream from an established Reclamation irrigation project at Riverton, Wyo., and the rest comes off the higher watersheds of the Wind river.

Because this dam was designed to have overage-capacity to provide for a considerable storage of silt (soil eroding from higher slopes), it has cost millions more than it would have cost had the silt been held as productive earth higher up stream. That overage capacity is "penalty cost" because **natural resource requirements of basic soil and water factors were not taken into consideration.** The only solution the Boysen engineers could figure out was to let the soil continue to erode, and then catch it by building a dam bigger than actually needed.

In February, 1948, there was an announcement that state and federal land administering agencies, and private owners on the Wind river watershed, would form the counterpart of a Soil Conservation District, to institute cooperative measures that would reduce soil erosion. The Wind river upland program is just now being translated from talk into action. Meanwhile, construction of the oversize dam goes on rapidly.

Two points to be made in this case history, are:

2. The plans developed for power plus irrigation plus flood control by the engineering mind, and under

1. The excess cost and the ultimate obsolescence of the Boysen project exists because of the policy of trying to "cure" a basic soil-water resource malady by applying a down-stream concrete "poultice," while the "sore" continues to fester from wounded earth surfaces upstream.

limitations of authority from Congress, do not include the basic, primary approaches. They are merely temporary moves in the long-time view. The **fundamental** point of attack is **conservation practices** WHICH THESE DAM STRUCTURES WILL SUPPLEMENT.

The most important illustrative point in this Boysen project, with its silt-catching capacity back of a costly dam, is the fact that so many projects of the entire water "development" program of the two federal agencies are speeding ahead in the magnitude already pointed out.

A national policy that disregards the necessity of keeping soil in place on uplands, of maintaining and developing water retention values in watersheds where floods and erosion originate, and then tries to meet the condition of displaced soil and compounded water runoff by building ever bigger dams, is going at the solution backwards.

Yet the plans of these federal agencies repeatedly embody provisions for catching the silt, trying to harness the gathered flood, down stream—instead of holding back both in the uplands.

The Boysen dam, with its provision for many acres of silt storage, its ultimate obsolescence, its loss of capital investment and service to communities below, is an accomplished fact. There is no way of stopping it at this juncture. But because it stands as it is, it is a telling monument to this phase of what is going on in approaching our soil-water resources across the nation. This sort of reverse "progress" **MUST** be stopped.

THE COLUMBIA RIVER BASIN

GENERAL — The water resource plans for the Columbia river drainage basin are comparable to those on the Missouri. The total cost of dams, plus diversion, plus power, and related projects, in this basin, now up for approval and construction, or in various stages of construction, exceeds **five billion dollars.**

There is one vital difference betwen the Columbia and the Missouri situations. There is no "wedding" between the plans of the Army Engineers and the Bureau of Reclamation as in the Pick-Sloan plan. Each has its program—same stream, same water involved, same resources affected.

Reclamation has announced that it will ask Congress for a "blanket" authorization for what it proposes to do in years ahead. The Army Engineers have their own "master plan" to put forward.

The Army held hearings at Seattle, Portland, Spokane, and Boise, about the first week of February, 1949. At these meetings, consuming some five days, the public had a chance to say its say about the big plans the Army has for "harnessing" the Columbia. **The Army Engineers are seeking blanket authority for the basin-wide scheme they have drawn up.**

Do we have two "complete" basin-wide plans here? And what happens if Congress **gives blanket authorization for both!**

Bonneville power dam, near Portland, Ore., was finished by the Army in 1938; Grand Coulee, farther up the Columbia, is a more recent completion by Reclamation. McNary dam, labeled for flood control and power, is being built on Snake river near where it joins the Columbia. Approximately 60 other dams and reservoirs are projected, ranging upstream to the Glacier View damsite on the North Fork of the Flathead river, Montana, where an important national park area would be flooded if the dam were built. Practically every tributary of the Columbia, of any size, has symptoms of "dammitis"—the Army type of the malady or the Reclamation type.

Principally in the name of flood control, the Army Engineers have a system of dams and related installations on Willamette river—which is a major program in itself. It simply is not within the scope of this booklet to cover all the potential questions that are raised, the apparent spots of crisis, involved in this double-jointed, unintegrated prospect of giant dams and doings on the Columbia river system. There isn't enough room. The announced plans of the Bureau of Reclamation alone fill a book two inches thick!

NATURE OF THREAT—The basic cause for concern in the Columbia situation is the same as that which exists in all river basins where (1) Reclamation, with its defined objectives, and Army Engineers with theirs, are racing to get authorization and projects started to "keep the ball rolling" in a big way; and (2) in so doing, with their different and limited objectives, fall far short of producing an inclusive, correlated basin-wide program for the best use of water in relation to all resources involved.

One of the primary issues involves the fate of the Columbia river salmon industry, estimated as producing $17,000,000 income annually. An undefined but considerable value, in addition, lies in the sport fishing derived from this resource.

Most important is the situation found here, as elsewhere, in relation to the Department of Agriculture. The planning and program which it might develop on upstream watersheds is lacking. As in other cases, without this the long-range view is that as we build the great concrete structures on the Columbia watersheds we will, figuratively, be pouring our dollars down a rat hole, and damaging other values as well.

The Army has taken full advantage of the public fears coming from losses of life and property in the Columbia flood of 1948. It is pressing hard toward getting clearance to go in and do mighty works to **control** the floods. Its "brass" is making speeches throughout the area, stirring the people to push for Congressional authorizations and appropriations. In this connection, the study made of the Columbia flood of 1948 showed that a large source of this disastrous flow came off mountain slopes far up the watershed that had been denuded. When warmish rain, plus sun, hit and melted the snow on these slopes, all the water swooped down at once, to create the flood. On adjacent slopes, where the timber cover prevented the snow from melting so swiftly, drifts were protected and did not melt out in a flash. Had similar cover been on the slopes where much of the flood originated, the disaster would have been far less. Actually, the loss of life was due to failure of an old railroad fill near Vanport, NOT to breaking of levee-protected banks.

TWO HIGH SPOTS—With 60-plus units of this whole grandiose plan, and with all having those fundamental defects of inter-agency competition and no coordination, every unit has some features and effects open to question. However, here are two high spots that indicate the need for review of all—with a viewpoint much broader than has been evinced by either agency.

Salmon Fork creek dam, in Idaho, built by the Bureau of Reclamation, was estimated to be capable of irrigating 100,000 acres. It actually proved able to water **only 15,000 acres.** An 85 per cent error in fundamental arithmetic! What a "blessing" this proved to be to veterans and others investing their time and money in a "secure" future on the land! What a waste of taxpayers' money!

Next is one bit of the "comprehensive" plan for the Willamette as presented by the Army Engineers; which **has** been held up, to the present time, by the efforts of the Izaak Walton League and other conservation groups, including local organizations.

In the name of flood control the Army Engineers had proposed a project on the Tualatin river; a beautiful, meandering stream in a recreational area. This proposal was to construct a concrete-lined trough through which the waters would be shot down into the lower country (to increase swiftly flood volume there???) with steel handholds every two or three hundred yards so anyone who fell in could climb out, if he would be able to do so! That sort of thinking and planning speaks for itself!

STATUS AND OUTLOOK—Blueprints in various stages, budgets, and everything set to get wide-open authorization from Congress to go ahead, full-steam; two agencies, competing within their particular fields. This is comparable in basic questions and problems to all other basins where Reclamation and Army Engineers are racing ahead, and in some places is far worse than others.

THE ROGUE RIVER CASE

GENERAL—The Rogue river is a "story" river. Praises of its beauty, its supreme sport fishing, its priceless gifts of memories to those who have visited it total a volume beyond estimate.

The Rogue's basin lies in southwestern Oregon, in the Cascade range, with the highest sources in the western edge of Crater Lake National Park, and its mouth at Gold Beach on the Pacific Coast. Within this rough, timbered basin, there are such tributaries as Big Butte, Wolf and Bear creeks and the Applegate and Illinois rivers.

The nature of the country traversed confines the Rogue and its tributaries at many points, to rather narrow valleys, and some spots where the waters traverse gorges.

The sport fishing in the Rogue is so pre-eminent among all streams of the nation, that the State of Oregon, in 1929, enacted a law prohibiting the construction of dams across the river below a specified point above spawning areas. Dams would interfere with the free passage of migrating fish. Later, in 1935, commercial fishing on the Rogue was prohibited by law, and it was thus dedicated to the use of the sportsmen anglers.

The following year, 1936, the Army Engineers were **authorized** to begin preliminary studies of flood control "in response to requests originating in the basin." Further studies were later authorized. The Bureau of Reclamation entered the picture, and has since taken the lead in power-irrigation planning activities.

The forecast of what might be in prospect for "harnessing" the Rogue brought a rising protest from many quarters. But the plans of the engineers were well worked out and on March 5, 1948, the Bureau of Reclamation, Region I, (Boise, Idaho, office) issued a 37-page booklet offering the public **two** alternative schemes. One or the other—take it or leave it!

Both schemes are characterized by impassable barriers across the flow of the Rogue and tributaries.

Following the issuance of this booklet, a "hearing" was held before the Bureau of Reclamation at Medford, Ore., June 8, 1948. In the booklet Reclamation had declared that the decision as to what might lie ahead "clearly should rest with the people of the Rogue river valley."

That was a statement of opinion. Others held different opinions. Conservation organizations had representatives at the meeting. Among these were the Izaak Walton League of America.

A glaring situation was pointed out in one I.W.L.A. statement. Namely, that Reclamation was laying before the people a choice of two plans. That in each plan the impounding of water for irrigation, power and flood control, by great structures across the stream, was the proposal; two choices, take one or the other. And that the whole field of what might be done in reducing flood damage and securing other benefits by land management higher up the streams, had not been considered.

The League proposed a third plan, plan "C," the "Conservation plan." Plan "C" would approach the problems of the basin on an inclusive basis, starting where such planning should start, with the land management and use phase.

THE ENGINEERING PROPOSALS —The proposals of the engineers are filled with statistical "justification" and "analysis" of the needs and benefits inherent in their blueprints. To attempt to detail these would fill—a 37-page book.

Here are a few high points:

Plan "A" would throw a salmon block across the Rogue far below uppermost spawning areas; Plan "B" would be only slightly better. Of greater, though more distant, damage would be the "additional power plans" for the Rogue, which would put impassable dams in the main stream almost all the way down to tidewater.

The Oregon Game Commission declares there is no feasible method of constructing fishways over the structures that would bar the stream.

Preliminary studies show that the value of fishing on the Rogue, in terms of annual expenditures by sportsmen, represents a capital value of $53,875,000.

Beyond this there is the contribution of salmon hatched in this stream to off-shore commercial fishing.

Add to that conversion of a lusty, dancing mountain stream into a series of fluctuating stretches of stream between dams, and many another maceration of what now exists, and the total loss is terrific.

The engineers have tables which show what would be gained, in dollar terms, by flood control, power, and so on and so on. But no amount of calculating machine figuring can efface the picture of one of the supreme streams of the nation as it now exists in its natural state, being put into a strait-jacket.

Latest information is that, despite powerful arguments against the Reclamation plans for the Rogue, the Bureau is still driving ahead. Concession has been made only to the extent of indicating a new survey of a few aspects would be started. Considering the adamant attitude of the Bureau in the past, we can see little hope for the future of the Rogue in what may next be proposed, so long as only a limited few technical agencies have a hand in the surveying.

THE THREAT—The essential threat in the proposals for the Rogue is the damage to existing values. If the Rogue can be taken into the grip of agencies which see in it only kilowatts and irrigation, then no stream may remain inviolate, no matter what its God-made qualities may be.

As to the Rogue, only the most determined efforts can hope to prevent its "harnessing." That its waters may be controlled and used for greater values than now derived from them, should not be blankly ruled out.

But, whatever plans may be followed to utilize more fully the Rogue's waters, should have the benefit of the study of foresters, land management planners, wildlife authorities, recreation planners, and all the other segments of what is involved in a total watershed program. Certainly what is planned by Reclamation at this time does not include anything adequate of this type. Whatever study of other factors that has occurred to date, has had to be carried on with the "power-irrigation-flood control" blueprints already drawn up and budgets made—by the engineers.

We might ask, "Who says damming the Rogue is necessary?"

The total cost of the project is close to **300 million dollars.** Of this only 61½ million dollars is assigned to irrigation, only 3½ million (plan "A") to flood control. The balance is charged to power values. Power to be used where? For what purpose? Where and how the 589,230 kilowatts produced would be used is uncertain.

CONSTRUCTIVE APPROACH — Before the Rogue is "developed to death," the **desirability** and the **necessity** for such a move should be challenged — with every contingent factor considered. **This is too important a matter to have it decided by a choice between two or three plans which have been made by men of limited viewpoint and interests. Who are they to decree the death of the Rogue?!**

THE CASE OF PUTNEY SLOUGH

This is another of the many units of the Missouri River Basin "Pick-Sloan" plan. It lacks appropriations and final authority to go ahead.

The city of Aberdeen, S. D., wants a supplemental water supply.

The Army Engineers are willing to build the reservoir. That use alone will not justify the project's costs.

One move to conjure up associated "benefits," is to drain Putney Slough, a large marshy area, into James river. It is to be converted into "agricultural land."

The water table in this section dropped some 70 feet during the drouth of the 1930s; draining of Putney Slough would destroy a major aid in maintaining the water table on adjacent lands.

Also, as lakes to the eastward, along the Minnesota-South Dakota border, were altered by dexterous engineering, this slough became the major resting place of northward migrating snow and blue geese. It is practically the only remaining such facility in this area for waterfowl. The U. S. Fish and Wildlife Service report of damage resulting if the slough were drained, was so overwhelming that the Army, on its first try, could not justify the project. Undismayed, the Army's District Engineer is reported to have stated at a meeting in Pierre, S. D., that the drainage area would be so enlarged that the "benefits" would override the losses indicated by the F. & W. S. report.

The slough is lower than the James river. A "drainage" ditch dug in the 1920s let water **from** the river flow into the marsh, so gates were shut! The Army COULD drain Putney Slough, though. It would do so by so lowering the bed of the James that slough water would run into the river instead of out of it. To do this, the Army would have to dredge and straighten the river channel for 45 airline miles. The folks downstream, upon whom the upstream water would be poured, don't like that any more than organized conservationists do!

A campaign is now understood to be under way at Aberdeen to try to "educate" conservationists so they won't oppose the Putney Slough project. Conservationists will be glad to listen to reason and to inspect plans that are inclusive and non-damaging to existing resources. But so far, nothing has appeared from Aberdeen or the Army to indicate that they have made any beneficial changes in original damaging plans.

One point to emphasize here is that Army Corps projects need not require repayment from whatever is supposed to be benefited! In this respect the Army Corps is Santa Claus —at the general taxpayer's expense.

MIDDLE RIO GRANDE RIVER PLAN

HISTORY—Before 1600, Pueblo Indians living along the Rio Grande between the present New Mexico-Colorado line and Albuquerque, were irrigating bottom lands with water diverted by 22 ditches. By 1880 irrigation along this section of the river had reached a peak, with 124,600 acres under ditch.

At the same time, the loads of livestock on the Rio Grande's watersheds built to high numbers. From 1880 there has been a steady increase in damaging floods, in silt in the river, and productive irrigated lands in this section have decreased from 124,600 to 85,000 acres.

The basic cause lies in injured watersheds.

The silt loads built up the river bed; the bottom of the river channel is four feet above Central Avenue, Albuquerque's main street. The river here is held back by dikes. As silt built up the river, lateral seepage waterlogged the more productive loamy soils adjacent to it. Waterfowl, muskrats and other wildlife found good habitat in such marshy spots.

In the middle 1930s, under state law, a "conservancy" district was formed, issued bonds, set up assessments against property benefitted. One dam was built; other structures were put in. By 1939 the district was in financial trouble. Unable to pay assessments, owners let 34,000 acres "go to the state" for taxes and unpaid assessments.

Silt carried down the channel entered slower-moving waters as it reached Elephant Butte Reservoir, built in 1916. A delta was formed. At first silt was running into the lake at the rate of 23,000 acre-feet per year. After the delta was formed, water slowed above it, inflow of silt to the lake itself declined; it was deposited above. Partial damming occurred at this point. Four new lakes were created; the largest, San Marcial. There are colonies of American and Brewster's egrets, the nesting areas of the rare New Mexico duck, on these lakes.

Above these lakes is the 56,200-acre federal Bosque del Apache refuge. It contains 7,000 acres flooded by ditches; fields between dikes where grains are grown, then flooded for winter use by waterfowl. The high water table produced by the river backing up behind the silt delta is a factor in maintaining these flooded areas.

THE PROPOSAL OF ARMY ENGINEERS AND RECLAMATION—These two agencies have entered the picture to cure the maladies of the river by dams, dikes, drains and dredging. They are planning to take over the conservancy district's burdens and failures. A principal reason for this, beyond a hope to rehabilitate some 25,000 acres of land, is that by their engineering plans they expect to be able to deliver to Mexico and Texas "demand" water that must be given to those lands under interstate and international compacts.

They propose to build three dams on the upper drainage areas. These will provide for storage of 300,000 acre-feet of **silt.**

The river above Elephant Butte Reservoir is to be "degraded" (dredged) six to seven feet below its present level, for 19.6 miles. Some 10,500 acres of "salt cedar" (tamarix) that has grown up principally in the Bosque del Apache refuge, is to be grubbed out because it transpires moisture. The four new lakes (excellent fishing there), will be wiped out. The wildlife refuge and its ponds will be affected. Elephant Butte lake will be held at a lower level, which will decrease the **surface area** by 3500 acres.

The entire project is estimated to cost almost 100 million dollars. But here is the most telling revelation in this whole case:

It is estimated that year after year it will cost $420,000 to continue dredging the 39,000,000 tons of silt that will continue to slough off watersheds above.

THE NATURE AND STYLE OF THREAT—The threat lies in the loss of wildlife plus no assurance that the basic conditions of silting and floods will be cured. Plus obsolescence. Plus annual upkeep. Plus "revised" cost estimates combined with dams already contemplated as a further "cure" if and when those now projected fill up. **This is an inclusive case history of the fundamental wrongness of a lot of the projects into which we are asked to pour 53 billion dollars.**

CONSTRUCTIVE APPROACH—Insist on proper land and water management from the mountain top down!

THE CALIFORNIA GRASSLANDS CASE

GENERAL—The San Joaquin river, second largest in California, originates in a big mountain basin in the Sierra National Forest, south of Yosemite National Park. Flowing southwesterly it runs into the flat country between Fresno and the Park. It then turns westerly, and finally northwesterly, north of Fresno, where the Kings river joins it near Mendota.

The Bureau of Reclamation has constructed a dam at Friant, trapping the waters before they get out into the flat of the Central Valley. By a series of existing canals, it is possible to divert water 100 miles to the southward, into a flat area south of Bakersfield, with sandy soil, which is devoted to potato and cotton growing.

THE GRASSLANDS—Before the Friant Dam was built, the San Joaquin came out of the mountains into a sandy loam area, where the gradient is such that diverted water not only irrigated fine pasture land, but also formed marshes, covering an area variously estimated at from 100,000 to 146,000 acres. A majority of California's dairy cattle are pastured in this region.

This marshy area has been one of the keystone units in the Pacific Flyway of waterfowl. The salmon run in the San Joaquin river, during spawning time, is estimated to have been about 200,000 fish each season. In that stretch of river which lies below Friant Dam, in the Grasslands, there also are trout, bass and catfish. Many values were produced by the San Joaquin water in the past. Along came the gigantic Central Valley project—and Friant dam.

Trouble over the destruction of these natural values of the Grasslands showed up as early as 1944. At that time Dr. Ira N. Gabrielson, then chief of the Fish and Wildlife Service, persuaded Commissioner Bashore of Reclamation to release 83,545 acre-feet of water from the Friant dam to maintain the Grasslands resources. That action, allowing that much water to flow, served the migratory waterfowl that season, and provided emergency pasture to support some 60,000 head of beef and dairy cattle. In order to preserve the waterfowl habitat on the area, it would be necessary to have 100,000 acre-feet of water annually allotted to this area by Reclamation.

Gabrielson definitely made the point in his memorandum to Bashore that this was far more than a local problem; that the entire waterfowl resource of the Pacific Coast is at stake because of the high importance of the marsh area in the Grasslands. Dry it up, and the Pacific Flyway has the center knocked out of it.

The San Francisco News, Nov. 1, 1947, reports the Grassland Water Assn. accusing the Bureau of Reclamation of deliberately planning to destroy fish and waterfowl dependent on waters from the San Joaquin below Friant Dam, by not allowing water to flow down the natural channel in enough quantity to protect these values.

At that time members of the water association filed suit against the Bureau of Reclamation and the Secretary of the Interior to force release of water through the natural channel of the San Joaquin in the Grasslands area. It was flatly charged that Reclamation was deliberately destroying the salmon run in that section of the stream, the wildlife habitat serving waterfowl; doing it quickly, so those "problems" would be "removed" and protests demanding water for these resources would cease.

Reports are to the effect that in 1947, when this issue became defined, Reclamation had contracted with the Grasslands Assn. for 60,000 acre-feet of water, plus another 20,000 acre-feet of "spill water" if the Friant Dam filled to capacity. Attorney for the Grasslands Assn. stated that Reclamation had arbitrarily cut this amount to 34,000 acre-feet, and when that amount had passed down the natural channel of the San Joaquin, the dam gates had been shut forthwith.

Under the program of releasing or cutting off water to dry up the channel of the San Joaquin between Friant Dam and Mendota, the salmon run reportedly shrank from an estimated 200,000 to some 6000!

One of the outstanding features of this situation is the fact that Reclamation and Fish and Wildlife are bureaus within the same Department. Whatever the administrative head may think or have said unofficially, it appears that Reclamation is decreeing the amount of water which will be allowed to flow in the natural channel of the San Joaquin below Friant Dam, when it shall flow, or if.

The Grassland Water Assn. filed its suit in the autumn of 1947, in Federal Court. The Izaak Walton League, California Division, has joined this suit as "friend of the court."

State laws of California provide that the owner of any dam shall allow sufficient water at all times to pass through so a fish-way will be operative, or in the event that is not done, enough water has to be released to maintain fish below the dam—the California Game & Fish Commission being the judge as to what must be released to protect the fish resource in the stream below.

A specific section of this law allows no misinterpretation whatever; it says " 'Owner' includes the United States," and goes on to declare that "the Legislature (enacting the law) declares that it understands that the law and policy of the United States with respect to the development of water resources, the reclamation of land from flood and overflow, and in all other respects is to comply with State laws respecting water."

So Reclamation, not having complied with the law, per se, and continuing to divert the water out of Friant Dam to the agricultural lands far to the southward (where dust storms often blow), the California Fish and Game Commission, on Dec. 14, 1948, joined with the existing plaintiffs to file action in the Superior Court of California at Los Angeles.

Far beyond the question that is raised with regard to a federal bureau complying with state law, lies another of most tremendous importance. That is, how far one agency can pursue an arbitrary course of action in determining the fate of all natural resources in a river basin.

This illustrates clearly the one-mindedness of certain types of intellects, which no doubt are excellent in their fields of engineering construction and "wizardry," but which either by narrowness within their own thinking or narrowness imposed by Congress in its acts, raise plain Hell-and-repeat as they pursue a one-track course.

This is a COMPLETED PROJECT! Damage already has been done. It has been done through the actions of officials of Reclamation. And those actions are so searingly destructive to values of high public interest, high public concern, that it almost compels the demand that opportunity for such bungling, blind and bull-headed administration, be taken away from those guilty and put in hands of others capable of viewing with broad and judicial outlook.

The existing values below Friant Dam can be maintained if sufficient flow is released through the natural channel of the San Joaquin.

THE OSAGE RIVER DEMONSTRATION

HISTORY—Here is an outstanding example of advanced planning for which not only the State of Missouri, but the Army Engineers, can be given the greatest acclaim. Having accented the gross deficiencies in coordinate and inclusive study and planning on other projects, the Osage plan is offered as a demonstration of excellent approach and results. Of highest significance, it is a unit of the Missouri Basin plan—one **exceptional** unit.

The Army Engineers, with their basic responsibility the control of floods, had made plans for one big reservoir on the Osage. Some power would have been developed from installations, but the principal objective was to have a structure which would catch and hold flood waters. The total storage capacity would have been 8,170,000 acre-feet, of which 5,605,000 acre-feet would have been flood control. At full-pool, the reservoir would have flooded 333,200 acres of land.

The 1944 Flood Control Act gave the states the right to review and participate in planning of projects before their submission to Congress. Although the Osage river reservoir had been authorized by Congress, the State of Missouri, working through its Department of Resources and Development, questioned the worth of the Osceola dam on the main stem of the Osage as against some alternative plan. The Army Engineers gave cooperation. That is **immensely to their credit.**

The new cooperative study of the entire Osage river basin began early in 1947. It was to take into consideration all factors and values.

Taking part were the Army, the Departments of Interior and Agriculture of federal government, and interested agencies of both Kansas and Missouri, including the Resources and Development bodies, the Conservation Commissions, and technical groups within the state university systems. (The Osage heads in Kansas, where it is called the Marais des Cygnes.)

Forty-two possible dam sites on 25 tributary streams were considered in addition to any main stem sites. Soil conservation measures were worked out for watersheds. Forestation entered in some areas. In short, all elements of securing the best solution for the problem, the greatest total benefits, were studied and the planning for all integrated.

The plan now provides for a system of nine reservoirs. Of these, eight are higher up on tributaries and for one smaller dam on the main Osage. Of the nine reservoirs, five are in Kansas—near headwaters, where floods can be harnessed when they are small.

Combined with this is that part of the plan which strikes at the very root of flood and erosion trouble—the program of land management on watersheds where floods start.

There will be 125,000 acres less land inundated under this plan than would have been flooded by the huge proposed main stem reservoir. Valuable coal deposits that would have been flooded will not be under water in the inclusive new plan.

The planning even went into appraisals of impact on local values and communities. It summed up and compared the effects on land uses and classification, farm characteristics, population, production, service facilities, business, mineral deposits, timber, local government and many other factors. This was a pioneering study, but it formed the foundation on which to put together the plan which would assure the least losses and greater benefits.

Some details still are to be worked out on the Osage. But the net result is, with this exemplary cooperation by the Army Engineers, and all other public agencies working together, a plan which starts at the high divide on every tributary of a river basin, and ties together all the fundamental factors.

This plan strikes at **flood prevention** instead of control, and as it does, also enhances other values affected by any plan which would have the solving of flood problems as one of the major objectives.

Here is a model for what can be done in many, many drainage systems. At the insistence of Missouri, it is even now being applied along Grand river, in the northern part of that state.

Summary of Army Engineers and Reclamation Programs

It should be emphatically stated that, in spite of criticism here offered, the dire need for searching review of such plans as cited in programs of both Reclamation and Army Engineers, there is no intent to oppose the orderly, integrated and inclusive planning of development of water resources in the nation. Nor is there criticism intended of the fundamental objectives of doing the best possible job in preventing flood disasters, or of securing benefits that can be attained when, as, and if needed, in watering productive acres and producing cheap power.

While there is much to be questioned and criticized in the actions and programs of these two agencies, particularly the gigantic lack of comprehensive planning from the initial point of study of land-soil needs which can be supplied by Agriculture, the most probing criticism should be directed at something far more basic. That is the conditions which have developed, with Congress having set up two agencies, dealing with one basic resource, each with defined limitations and objectives, and then giving authorization and funds for them to "fight it out" to see which can be "bigger and better." This, with no requirement that whatever either agency may do must include integrated planning with regard to other phases of natural resource needs and uses **from the outset.**

In the past, piecemeal dealing with water resource problems may have been condoned. What has been done, however, is less than ONE TENTH of what is proposed in the future. With the gigantic proposals before us, with the conflict between two major agencies, with the vast deficiency in their plans with regard to full coordination with other natural resources involved in water uses, we have a point of terrific crisis.

Each unit, illustrated by examples presented, may have in it local elements of crisis — for example the destruction of salmon, waterfowl and pasturage on the San Joaquin river. But whatever these local crises may be, they root back to the fundamental situation of two agencies seeking blanket authority to go ahead on plans that, on even the most preliminary review, raise great questions.

The net situation calls for major action. A moratorium should be declared on approvals and appropriations for Reclamation and Army Engineers for a sufficient length of time to have their schemes studied by competent people who will consider all additional factors. The need for eliminating competitive situations between the agencies, the combination of the work and who will do it, should be evident. The imperative necessity for soil-water planning at the "grass-roots," the agricultural phases, is clear.

We cannot afford to go further on the path now being followed in water developments across the nation under the present set-up without facing grievous, hurtful results in great degree.

Short References to Other River Basin Proposals

Moorhead Dam, Missouri River Basin—Already authorized and partially under way, this $24,000,000 structure is the reverse of what the people in the area want. Its site is on Powder river, just north of the Wyoming-Montana line. The people in the Powder valley want small spreader dams and dikes in the creeks and gulches that come in from either side, to hold down the soil, to build up its productiveness, to lessen flood threats. More than $1,250,000 had already been spent at the end of 1948—and the chief visible fruits of that spending were a dozen bungalows to house government workers, a graveled access road, some core drilled samples to indicate foundation conditions, and blueprints in a district Reclamation office.

Gunnison - Arkansas Diversion—This is a half-billion-dollar, plus, project to divert "surplus" water from the Gunnison, in the Colorado river basin, through the continental divide into the Arkansas river valley, for irrigation, power and additional municipal water supply. There is a grave question of whether water can now be spared, in view of potential demands in western Colorado to operate shale oil plants. There is a grave questiion of whether the project would damage the existing high quality recreational industry in the Gunnison valley. There is some question of whether the life of any eastern slope reservoir would be long in view of the terrific volume of silt now being eroded from the high country in the Arkansas basin. The Gunn-Ark diversion project should be opposed until these questions have been resolved.

Blue-South Platte Diversion—Similar in many respects to the Gunn-Ark project. Most of the same considerations apply. Located in Colorado.

Missouri-Souris Diversion—Water from the Missouri would be diverted 150 miles by canal into the Souris river, to raise the level of drying Devil's Lake, North Dakota, and then go on into the Sheyenne river to swell the flow of the Red river of the North, which travels to the Arctic ocean. Among serious questions raised are whether sufficient water waterfowl refuges are affected.

Upper Mississippi Wildlife and Fish Refuge—This was established about 1924 at the insistence of the Izaak Walton League, when private interests sought to damage and exploit the river bottomlands in the Iowa-Wisconsin-Minnesota border region. The refuge embraces some 122,000 acres. Beginning in 1930 the Army Engineers built a lock-dam system from around Grafton, Ill., upstream to the Twin Cities, to provide a 9-foot navigation channel. Conservation interests forced the Army to stop drawing down the upper pools in winter, dropping ice to smother fish and otherwise damage wildlife and wildlife habitat. Now the Army wants to put in a 12-foot navigation channel. Conservationists have indicated they will not seriously oppose this, **provided the end is gained through deepening the existing channels rather than raising the height of the dams and flooding new areas.**

Potomac River Basin—In 1944 the Army Engineers were decisively beaten by the conservationists in their efforts to put a series of dams across the Potomac and its tributaries upstream from Washington. There was a literal uprising of the people, and within 24 hours the Board of Engineers for Rivers and Harbors, acting with unprecedented swiftness, withdrew the project. Recent events point to a possible revival of the Potomac plan, possibly in some revised form. Extreme alertness is cautioned! Meanwhile, a flood control plan for the Potomac uplands, put forward several years ago by the Soil Conservation Service, has so languished that a complete new survey may now be necessary to full success.

Kern River, California, Diversion—This involves complete drying of the Kern streambed for about 10 miles above Bakersfield, Calif., by diversion of flow to turn the turbines of a plant operated by Southern California Edison Co. Under law, where such diversions are on public lands, the rules laid down by the land administering agency must be followed. This diversion is on national forest land, and the Forest Service has demanded a minimum flow of 50 cubic feet per second. Decision lies with the Federal Power Commission. In a similar case involving the California-Oregon Power Co. and Umpqua river, Oregon, the company readily agreed to stipulate a minimum flow of 100 c.f.s. on request of the Forest Service. This case is important because many other western streams may be affected, beneficially or adversely, depending on which way the Kern case decision goes. Its official title is F. P. C. Project No. 1930.

Illinois River dams—The Illinois flood control project started out a few years ago as one of those typical jobs where rich bottomlands would be flooded by reservoirs intended to hold back occasional floods. Insistence of conservation groups and concerned individuals brought a temporary halt while alternatives were studied; these include returning levee districts to the river and managing as wildlife regions and public recreation facilities the lands and waters restored to the flood plain.

Libby dam, Montana—This is a unit of the Columbia basin project proposed by the Army. It is on Kootenai river. The reservoir would flood out the town of Libby and so much of the valley land that the timber economy of the entire county would be badly disrupted, if not actually destroyed.

St. Lawrence Waterway Plan—Exceedingly little late or comprehensive information has been made available on this project, which has been hanging fire for several years. Best information at present is that numerous islands and shallows of the St. Lawrence, between New York state and Canada, would be inundated if the project goes through, and the fate of one of the country's finest smallmouth bass regions would be in jeopardy. A thorough study and report on recreational resource impacts and results would be welcomed.

Central Utah Project; Reclamation—While not yet in final form, it appears that this project, as now outlined, would completely ring the Uinta mountains, highest and most spectacular in Utah, with irrigation canals which would seriously disrupt fish habitat conditions. Granted that Utah needs water, the principle of a full investigation of all resource factors, from the top of the mountain down, applies.

Central Arizona Project; Reclamation—Even conservationists of Arizona despair of getting effective control measures under way ahead of construction on this $738,000,000 proposal. The Bridge Canyon-Kanab projects mentioned elsewhere are parts of this one. The cold fact is that the irrigable parts of Arizona already are overdeveloped; the people on the land are using up available water—surface and subsurface—faster than nature can provide it. In order to keep going along the lines now marked out, they want more and ever more. It is human to aspire, but where is the stopping point? To raise the question lays us open to accusations of trying to block "progress." So be it.

CRITICAL SITUATIONS IN NATIONAL PARKS and MONUMENTS

GENERAL—The threatening situations in our National Parks and Monuments are exploitation versus preservation of those values for which the park system was established. It is a question in every case whether the park areas, the park concept, shall be surrendered to interests that find it convenient and to their profit to exploit some resource in the parks and monuments, and in doing so, break down and undermine the whole vast system of recreational values we have preserved within these public properties.

The park and monument system embraces less than 1% of the total area of the nation. It would seem that we can afford to keep these areas inviolate.

JACKSON HOLE NATIONAL MONUMENT

HISTORY—No one controversy of the past few years has blazed across the country as the one over whether a few local interests shall succeed in abolishing this public reservation.

Many years past, many people began to propose that the superlatively scenic, recreational, educational, scientific and historic values that exist in the present Jackson Hole National Monument should be preserved for use and enjoyment of all citizens. In 1919 a movement toward this end was embodied in a bill, H.R.13350, introduced by Rep. Mondell, Wyoming, to extend Yellowstone National Park southward to embrace the present Grand Teton National Park on the west side of Jackson Hole and much of the present monument. It was passed by the House; blocked in the Senate. In 1923, local citizens attempted to raise funds to purchase private holdings within the present monument area, to donate these to the nation. They were unable to raise sufficient funds.

John D. Rockefeller, Jr., became interested while visiting the area; in 1926 he offered to undertake acquisition of private lands to be given to the nation when it became firmly established as a park or monument area. In 1927-28 elected officials of Wyoming, members of Congress, and Interior Secretary Work approved a purchase-donation plan, and President Coolidge withdrew Jackson Hole lands from entry to facilitate the program. The Rockefeller purchases started.

In 1929, Interior Secretary Wilbur visited the area, approved its preservation, and President Hoover concurred.

In 1930 the U. S. Senate Special Wildlife Committee visited Jackson Hole and a group of local citizens proposed establishment of an area larger than presently is within bounds of the monument, to be held for that sort of use.

In 1934, Sen. Cary, Wyoming, introduced a bill to add the Jackson Hole area to Grand Teton National Park; the bill was reported favorably to the House, but was not acted on before adjournment.

With this as history, on March 15, 1943, President Roosevelt, acting under the "Antiquities Act" of 1902, under which authority all national monuments have been established, proclaimed the present Jackson Hole National Monument.

The exterior boundaries encompassed 223,000 acres. Of this 77.6% was federally owned, 15.2% had been purchased by Rockefeller, 6.6% were privatley owned, and 0.6% belonged to the State of Wyoming.

About 8000 acres within the monument were under cultivation, principally growing hay; 2500 of these acres were irrigated. Of the total monument area, about 54,000 acres had been used by private parties for stock; about 6300 head of livestock grazed this area for brief periods each season.

A small group of individuals immediately began a violent campaign to smash the monument.

These opponents were and are politically potent in their particular localities. Congressman Barrett, Wyoming, introduced a bill in Congress in 1943 (H.R.2241) to abolish the monument. Political interests filed suit to test the legality of the proclamation establishing the monument (with every other monument's legality involved in the outcome). The suit was lost.

Barrett's first bill to abolish the monument passed Congress in 1944, probably without the import of the measure being realized, but was pocket vetoed by Pres. Roosevelt.

Undaunted, Barrett introduced H. R. 1330 in the 80th Congress, again seeking to wreck the monument. By this time conservationists were aroused over the entire nation. Barrett got the bill reported favorably to Committee. It never got out of Rules and back on the floor.

During this squabbling and the attempts to smash the monument, clear evidence emerged that just a few, a very few, determined individuals remain as the core of opposition. Most Jackson Hole residents favor the monument as is. National expressions of condemnation of the move to abolish were plainly the reason for Barrett's H. R. 1330 being "killed" in the Rules committee last session.

It should be apparent at this juncture, that the public is determined to prevent a small group of individuals from smashing the monument. It now has been established approximately SIX YEARS.

THROUGHOUT THOSE YEARS opponents to the monument have succeeded in placing a "rider" on National Parks appropriations, **prohibiting** expenditure of funds on development and administration of this public property. There has been a terrific increase of tourist travel to Jackson Hole. Congestion is great in Grand Teton Park, and it is imperative that additional facilities and space be developed in the adjacent Jackson Hole National Monument.

Far beyond that is the principle of whether such action as the opponents attempted can break down the monument. Reasons advanced by the opposition have been that the grazing (of 6300 cattle; short season) is of paramount importance; that Teton county would lose tax income; that people in the "monument would be dispossessed;" and other far more extravagant contentions. All valid existing rights have already been protected, and the county would be assured full reimbursement for any lost local taxes, if legislation proposed repeatedly in the past had been enacted.

STATUS—**The monument has existed, undeveloped, six years because of that recurrent rider on parks appropriations.** The question is, can one selfish, stubborn group continue to deny public use of public property by such methods. **It must be accepted that after six years of failure to abolish it, the monument is an ESTABLISHED FACT.**

Nobody should underrate the Jackson Hole National Monument controversy. **Jackson Hole National Monument is a test battleground involving the whole principle of private exploitation and greed versus public interest.** The public should demand funds to develop it!

THE CASE OF GLACIER VIEW DAM

"Glacier View dam is probably the greatest threat to the integrity of the (National) Parks right now."

HISTORY—This project of the Army Engineers will be publicized among conservationists. It is a "unit" of the Columbia River Basin grand plan. It is labeled a flood control project, but actually involves power production more than anything else—three generating units producing 71,500 kilowatts.

In a report of Oct. 1, 1948, North Pacific Division, the Army Engineers, states that this dam, on the North Fork of Flathead river, would create 3,160,000 acre feet of storage capacity, and "completely control this branch of the Flathead river." The dam will be an earth embankment about 416 feet high and about 2100 feet long.

Quoting directly from that report, "Glacier View Reservoir will, at normal pool, cover an area of about 48 square miles, about one-third of which is Glacier National Park land. Nearly all of the reservoir area is covered with second growth, brushy fir and lodge-pole pine. Flowage costs will be relatively low, as the area is **essentially undeveloped:** there are, however, 38 privately-owned homes, a store, six Park and Forest Service building groups, forest roads, telephone lines and minor mineralized but undeveloped areas in the reservoir area."

The reservoir would inundate 19,840 acres of land within the park.

During the 1948 flood, the crest from the North Fork of the Flathead river did not reach the lower Columbia river reaches until some ten or twelve days after the crest of the main flood had passed and subsided.

WHAT IS THREATENING? — Beyond all other factors involved, is the primary one of invading an area, selected and set aside for park use, for the preservation of natural conditions, by a use utterly foreign and destructive to those to which a national park is dedicated. To propose this dam is sheer contempt for the guiding principles which brought our national park system into being.

The area that this project might wipe out in one of our greater national parks is of high importance in itself. But far beyond that is the inherent threat to all national parks through establishing this precedent.

Contrary to the estimates of the Army Engineers that timber flooded would be "scrub," the Park Service states that 8000 acres of virgin timber would be lost; a portion of it one of the best remaining stands of Ponderosa pine found in the northern Rockies.

The flooding of this area would wipe out over half of the winter range of northern white-tail deer in the park. It would destroy 30% of the winter range of the park's mule deer and elk. About 70% of the beaver habitat in that locality would be flooded out. Over half of the moose in the park are found in this area, and they live on the existing swamp, meadow and lake margin vegetation — their principal food source. The reservoir would condemn the moose herd there to practical extinction.

STATUS — The Army Engineers have gone into this national park, (1) as a part of their inclusive "staking out" of potential dam sites on the Columbia drainage, and (2) because a part of the act in which the U. S. accepted jurisdiction over the park May 11, 1910, had a clause which stated that irrigation projects might be allowed within its boundaries. This was inserted because Reclamation at the time, **did** have two minor projects set up within the park. It was a compromise of the moment and no blanket permission for anyone to dam other park waters.

The Army Engineers held hearings at Kalispell, Mont., concerning this project, on May 25, 1948. Many protests against the dam were made; one outstanding statement on the part of the Master of the Montana Grange. Another, equally forcefully, was made by Dr. Olaus J. Murie, representing the Wilderness Society. Local people, other organizations, protested.

To indicate the mass of opposition to Glacier View dam, here is a partial list of organizations which have gone on record against it: National Audubon Society, American Planning and Civic Association, New York Zoological Society, Sierra Club, Dude Ranchers Association, Wildlife Management Institute, Izaak Walton League of America, American Nature Association, American Society of Landscape Architects, Campfire Club of America, Ecological Society of America, The Wilderness Society, Federation of Western Outdoor Clubs, the Garden Clubs of America, General Federation of Women's Clubs, the Mountaineers, Inc., National Recreation Association, Prairie Club, Save-the-Redwoods League—and others.

Believe it or not! In the face of such protest, the Army Engineers' report referred to above, prepared by the Portland, Ore., division, dated Oct. 1, 1948, following the "hearing," **recommended this project for approval by Congress! Secretary Krug wrote a protest to the Army.**

Secretary Draper is quoted as having replied that "every consideration will be given to your views in the formulation of the recommendations of this (Army) Department to Congress with respect to the Glacier View project." And added, "all aspects of the problem, including the **desirability** of preserving public park areas, as well as the **need** for flood control will be given careful consideration by this (Army) Department with the view to arriving at recommendations to Congress that will meet the desires of all concerned **to the fullest extent possible."**

We ask: What is "fullest extent possible?" Doesn't that say, in about so many words, that the Army Engineers will cast a glance at the violation of the national park that would ensue, will weigh the "desirability" of preserving the park against the "need" for flood control, and then go right ahead as originally planned? The fact that Glacier View dam is still on the Army list for approval seems proof enough.

THE SITUATION AHEAD — This is a crucial case. If the Army Engineers can disregard everything except their own ideas, then no areas, no natural values, are safe while they still run at large.

Here is an extreme illustration of the un-organization of agencies, as between them, in dealing with our natural resources. By all the evidence, the Army Engineers are unqualified in the extreme in this case, to determine anything except the "engineering feasibility" of the project. By all evidence they are bypassing all other interests, and recommending the project before Congress.

In Glacier View dam there is a local issue involving one park. But along with its purely local features, **there is a national issue of the most vital importance to not only the National Parks everywhere, but to the citizenry as a whole.**

That issue is, whether any agency of the Federal Government may hold such power and prerogatives as to be able to go its way, do what it wills, regardless of other considerations, other people, and the national wellbeing—and make us like it!

If the determination is to be made as to how much of a law-unto-themselves the Army Engineers may be in such projects—here is the place and now is the time to make that determination.

FLOODS FOR MAMMOTH CAVE NATIONAL PARK

HISTORY—This is an amazing example of one federal agency proposing a project which would largely ruin values in public property administered by an agency in another department.

In 1926, Congress authorized the Mammoth Cave of Kentucky to be made a national park. Private lands inside the area were purchased, largely by donated private funds; condemnation suits were settled; and on Sept. 18, 1926, the park formally was dedicated. It took 20 years to achieve the goal.

In the same newspapers that locally hailed this achievement, readers were informed that the Army Engineers proposed a "flood control" dam on the Green river, below the park, and that if constructed, this dam would back up water which would flood the chambers of Mammoth Cave to such an extent that the famous underground "Echo River" would be flooded 24 feet.

During the time water would be impounded, no visitors could possibly be taken through the chambers. Far more threatening would be the aftermath, even though waters were not impounded except on intermittent occasions.

The underground rivers carry silt Backed up, this silt would settle in still waters caused by impounding. After each flooding there would be necessity for cleaning up the cave.

Flooding would probably coat the beautiful formations now found in the cave. Silt would fill present underground channels. Underground gardens of ferns would be submerged and killed. There is a question of whether the "blind fish" and other strange aquatic life would survive the floodings.

There are corridors and caverns still in the park which have not been fully explored or opened to the public. These would be inundated and probably ruined.

Over long stretches of time the cave would be closed because it was filled with water.

Plans of the Army Engineers are for a dam on Green river, which would back up water to an elevation of 450 feet. Those who have investigated declare that holding water back in the Green river by the proposed dam, at any level higher than 421.2 feet, will so flood the cave it will force it to close, since visitors could not go through.. Even at that level, damage will begin in the cave.

The Army Engineers contend that the benefits from "flood control" below the dam they propose will vastly outweigh the "economic" loss of the cave flooding.

STATUS—The plans are made for this dam. The project is up for approval.

This is a case history involving the whole principle of cross-purpose activities between bureaus in separate departments that should be associated under one correlating, coordinating directional head!

Grand Canyon Threats

GENERAL—As part of the **Colorado River Basin** scheme which embraces the entire watershed, and of which the previously mentioned Colorado-Big Thompson diversion is a part, two proposals by Reclamation have a direct bearing on values in Grand Canyon National Park and Grand Canyon National Monument.

BRIDGE CANYON DAM — This huge dam would go in the Colorado near the lower end of Grand Canyon National Park, and would back water for 18 miles into the park.

This, as an invasion of the national park, would be undesirable, but its worst aspects are in connection with associated plans of the Bureau of Reclamation.

The Marble Canyon-Kanab project is the real whinger in this case. At Marble Canyon, upstream from Grand Canyon park, a diversion dam would be thrown across the Colorado river, and all water above a minimum flow of 1,000 cubic feet per second would be detoured out of the great canyon to Kanab creek. The water would be sent through a tunnel 42½ miles long, under the Kaibab plateau, to gush down penstocks to a power plant on Kanab creek. The diversion would destroy much of the wild beauty of the river plunging through its canyon, by cutting its flow to the bone.

Eliminate the national park factor and Bridge Canyon dam alone could be tolerated because of other benefits that reasonably could be expected. The lower part of the present park is not especially spectacular, by comparison. Above the present park are two areas which ARE of park caliber. These are Vasey's Paradise, a lovely spring in the desert, with a small green valley, and Red Wall Cavern, 450 feet wide and 250 feet deep, eroded in the canyon wall.

Take the lower 18 miles out of the park and increase its upstream boundaries to include Vasey's Paradise and Red Wall Cavern, and we could stomach Bridge Canyon dam—but NOT KANAB.

Bridge Canyon would prolong the life of Hoover dam and Lake Meade, by holding back silt that now threatens them. This points up Reclamation's shortsightedness in the matter of silt. All that Bureau can propose seems to be still more silt-catching reservoirs, rather than upland control of erosion. Fourteen per cent of the Colorado's watershed above Meade is in Navajo Indian reservation; that reservation gets only 2½ per cent of the basin's moisture, but contributes 20 per cent of Lake Meade's silt. **What is being done by Interior to correct that situation?** moment—but it is all triggered up to shoot for approval and later appropriations.

In both of these instances, the most pertinent factor is that plans are drawn or in the making to set up such projects. The Bridge Ferry project is all ready to **go ahead** if authorized.

Everglades and Flood Control

Army Engineers propose a project affecting the flow of water draining from Lake Okeechobee, south, across Everglades National Park. Detailed reports are not available, but the purpose is to provide fresh water for the Miami area and to control floods.

General appraisal at the moment is that the threat is not too serious, but its potential is to raise cain in the national park. Full plans should be reviewed; no appropriation should be granted for a "start" that has a great chance of ending in an "enlarged project," as often happens after one is once begun!

Everglades Park Extension

Congress authorized in 1944 a total of 2000 square miles in the park. Bills were introduced in the 80th Congress to pave the way for including privately-owned and state lands in the park.

Although conservationists a year ago strongly urged the Park Service NOT to grant mineral rights on any private lands to be acquired for rounding out the Everglades park boundary, such a right, extending until 1956, was given to one land company. As a BUSINESS proposition, it may have been a good deal, since chances appear slim that oil will be found under the 'Glades. However, this was very bad as a precedent-setting affair. It may make it difficult for the service to withhold similar rights when acquiring existing private interior holdings within other existing national parks.

PARKS OR POWER-HOUSES—KING'S CANYON, CALIFORNIA

HISTORY—One of our newer major parks, 438,000 acres lying directly north of Sequoia National Park, includes the two scenic basins of the Middle and South forks of the Kings river. As early as 1891, John Muir urged national park status for this area. The Sierra Club, of which John Muir was first president, (1892-1914), consistently urged that it be made a national park. In the last ten years, this area, comparable in its way to Yosemite, has been designated a national park, and has increasingly drawn people to it.

At the time the park was created, two areas of park quality at the western side were not included within its boundaries. They are the Tehipite and Cedar Grove areas. The former is the "vestibule" canyon floor, the main introduction as one enters, to the Middle Fork of Kings river. Cedar Grove is a similar unit on the South Fork.

The reason for exclusion of these areas was a compromise at that time, with irrigation interests in the San Joaquin valley. These spots are potential reservior sites, and had tentative consideration by Reclamation for that use.

With outstanding cooperation by the Army Engineers and Reclamation and the valley irrigationists, it was possible to develop a reservoir farther down stream, after the Middle and South forks had joined, at Pine Flats, well west of the park boundary. The highest commendation for this arrangement as against "reservoiring" in or adjacent to the park, should be accorded the Army, Reclamation and local irrigationists. Pine Flats reservoir, with 1,000,000 acre feet capacity is under construction at this time. It is judged it will utilize all the available water for irrigation, impound it, create new values, without injuring other values.

This solution has largely, if not completely, met irrigation and power needs in the immediate area.

However, another governmental unit, the city of Los Angeles, has thrust itself into the scene, attempting to revive old filings on dam sites within the Kings Canyon National Park.

The Los Angeles filings were made in 1920. They were rejected by the Federal Power Commission in 1923. Quiet through the years, the Department of Light and Power, on May 4, 1948, submitted a written application to the Federal Power Commission to **revive** and reinstate these old applications. The reinstatement was denied. Reliable reports state that representatives of Los Angeles have said that either there would be new filings on these sites or **a bill would be introduced in Congress to allow an invasion of the national park area.**

Three reserviors are smack in the interior of the national park. A fourth, outside, would flood Tehipite valley. A fifth would flood Cedar Grove. The last named two are the "vestibule" areas to the canyons above, not included in the park when it was created because of irrigation potentials—now fully realized when the Pine Flats project is completed!

The Federal Power Commission definitely states that it has no jurisdiction inside the national parks; the Secretary of Interior has that. But in the case of Tehipite and Cedar Grove, outside the park, it may have jurisdiction.

The Los Angeles proposal includes 44½ miles of covered conduits, tunnels and penstocks; power houses; high-voltage transmission lines. The projects would be for "power" alone, since all irrigation water available is alloted to the Pine Flats reservoir.

"The problem has its economic and political as well as its philosophical ramifications. It involves the battle of public versus private power, power versus irrigation, conservation versus exploitation. Long-range consideration must be given to the life expectancy of dams, to the possibilities of developing atomic power which might be used in part to distill seawater for coastal desert cities; for whatever we do to our national parks will certainly be long-range destruction." (Sierra Club Bulletin, May, 1948).

THE THREAT is apparent. The history of Hetch-Hetchy, and how the power-pressure of that day made that gem-valley into a reservoir-power mechanism, should warn of what might impend at Kings Canyon.

More imminent is what may happen to Tehipite valley and Cedar Grove, those areas now outside the park, but which physically and functionally, should be included within the park. The reason for their original exclusion has passed; the Pine Flat dam has met the needed impoundings these two areas might have supplied.

Reclamation is making a survey of further possible projects, which will include Tehipite and Cedar Grove—for they are outside the national park. **But they should be inside the park.**

CONSTRUCTIVE APPROACH—The first vital move is to recognize the status of the park-stature areas at Tehipite and Cedar Grove, and by amendment of the act creating Kings Canyon National Park, include them—as they should be.

Beyond that, although the Federal Power Commission has rejected the application for reinstatement of the Los Angeles filings, rightfully pointing out that the FPC does not have jurisdiction inside national parks, Los Angeles may pursue either of two courses, or both. New filings may be made—and would most certainly be rejected because of the park status of three sites involved. On Tehipite and Cedar Grove, if they remain in present status, the city's application might be rejected, but Reclamation be given the go-ahead. The other course of the city of Los Angeles would be to attempt to put through a bill in Congress to allow their projects to ram into (and practically gut) the park.

The argument advanced for the need to set up these power projects, is that the increased population of the area must have this power to continiue to thrive. The answer to that is very, very simple—and irrefutable. Increased population demands the preserving of ample facilities for recreation just as positively as it demands power. Power can be produced by other means; even hydroelectric power can be produced by installations at other points not jeopardizing the magnificent values in this national park. If the qualities which make the King's Canyon National Park station are defaced, if not destroyed, there is no replacement or substitute.

Only concerted and unified national strength can thwart the power-pressure-political sort of attack which might develop in such a case as this.

The Tehipite valley and Cedar Grove areas should now be included in Kings Canyon National Park. That is a first, protective step.

Beyond that lies the need for constant, determined vigilance which will blast any move to make a power-house out of the natural wealth we have in the scenic and inspirational environs of Kings Canyon National Park.

THE OLYMPIC NATIONAL PARK CASE

HISTORY — In 1897 President Cleveland created the 2,188,800-acre "Olympic Forest Reserve." In 1901, a fifth of the reserve was eliminated and quickly logged. In 1904 the first agitation for a national park in the Olympics began, and in 1909 T. Roosevelt established Mount Olympus National Monument. .Under the pressure of those who wanted to log, half the national monument was eliminated in 1917. Wallgren introduced a bill in 1935 for the creation of Olympic National Park. The bill failed in three sessions of Congress; was enacted in 1938 with powerful support of local people and national conservation organizations.

Additions based on a careful study were made by Congressional action in 1940. In 1942, lumber interests attempted to get hold of stumpage within the park, claiming this was the major available Sitka spruce stand. The Secretary of the Interior stopped this raid, pointing out that spruce was available elsewhere. In 1946 another raid started, based on a cry for "veterans' housing." Lumbermen's trade publications pointed out sufficient lumber existed in other locations and this attempt fizzled.

But in 1947 a new thrust to shear off sections of this national park began. The scheme was to take from the park, areas containing great stands of virgin rain forest (and of course quite a spot of lumber in terms of local logging activities). Not one, but a whole handful of bills, went into the Congressional hopper. The confusing pattern resulting brought pulling and hauling. But the essential feature is that some 34,000 acres of forested wilderness on the west slopes of the Olympics were to be chopped off the park.

The essential motivation for the proposals is found in the capacity of local lumber mills. They are built to cut not the annual increment of sawlog timber in the area, but to exploit the existing forests on a large capacity basis. Having cut much of the timber that had been growing there over long years, not **harvesting** but cutting into capital stock, they must have more "virgin" forest to keep going at the rate for which they are organized.

On the west side of the Olympic National Park there are these stands of great old rain forests. They are wilderness, a part of the complete park, an outstanding feature to be preserved as representative natural forest. When all other similar areas, outside the park, are logged off, this can remain to show what conditions were before such cutting took place.

Lumber mills in other sections of the country, where cut-it-all-now tactics wiped out the original stands of timber, have had to adjust to a program of continued-yield cutting. The giant mills that ripped up the forests of the lake states, the east, the south, "ate" themselves out of logs. Now, mills operating on the sustained-yield basis are a stable industry in those boom areas of the past.

Mills of the area involved in the effort to whittle off part of Olympic National Park will have to come to an adjustment, too. Even though the park were opened to lumbering now, the lumbermen would merely be postponing the inevitable.

High prices for lumber are an incentive to those who want timber within the park.

The basic question is, whether the nation as a whole should deliver a bit of forest that will become increasingly valuable as representative of original conditions, to a localized, special interest demand that will forever wipe out the value of that forest as it now stands.

NATURE AND STYLE OF THREAT—The threat is easily seen. In the first place, this is another attempt on the part of commercial interests to break down the very essence of national park objectives for immediate profit to a few. The real answer to the national need is not this bit of lumber; it is the application of sound resource management to all our timber lands to produce more abundantly, over the years, on a sustained basis. Whatever might be thrown into the pot at this time by cutting these forests in the Olympic National Park is of little consequence in relation to the lumber supply even today.

Here again is the fundamental threat to national park integrity, just as in all similar prowls which would be profitable to a few individuals.

If this were to go through, every stand of timber in every national park would be in jeopardy. If that relatively minor stand of timber in Olympic is so badly needed, then every park should be opened to the logger. That is the height of fallacy. The timber in the national parks cannot be of such volume, such importance. Nothing short of national survival should be advanced as a reason for cuttinig timber in the parks for commercial purposes. Opening up a timber stand of any sort in any park just to keep some certain few mills running at a capacity which is above the sound practice of harvesting local annual increments, doesn't meet "national survival" conditions.

So the whole issue of lumbering for commercial purposes in the national park system is involved in this one case.

PRESENT STATUS—No bills proposing dismemberment of the Olympic National Park passed the 80th Congress. Most probably there will be new bills introduced to chop up the Olympic National Park and keep the local lumber mills running. It is almost as certain as sunrise and taxes.

THE WAY AHEAD—The conservationists are far better alerted to this threat than most other critical situations, partly because a nationwide issue is involved.

Among organizations opposing this dismemberment of the Olympic are: American Alpine Club, New York American Museum of Natural History, American Nature Study Society, American Planning and Civic Association, Boone and Crockett Club, California Alpine Club, D.A.R., Sierra Chapter, Emergency Conservation Committee, Game Breeder and Sportsman magazine, Izaak Walton League of America, Mazamas (of Oregon), Mountaineers, Inc. (of Washington), National Council of State Garden Clubs, National Parks Association, New Hampshire Federation of Garden Clubs, Obsidians (Oregon), Prairie Club, Sierra Club, Wasatch Mountain Club, Washington Alpine Club, Wilderness Society, and Wildlife Management Institute.

The magnitude of opposition to this proposal to cut up this national park is impressive.

Watch and watch, therefore. The price of protecting those values which belong to all of us from exploitation by the profit-seeking few, is constant vigilance.

GRAZING IN THE NATIONAL PARKS

Most people do not know that the grazing of privately-owned domestic stock is permitted in a number of national parks.

Generally, this situation is based on concessions to livestock operators who held permits on lands at the time the parks were established. Many parks were formerly national forest areas. Stockmen held grazing permits under Forest Service regulations. To oust these operators carried a degree of inequity. As a fair means of allowing them to adjust their operations over a long period, such livestock owners were assured lifetime permits to graze stock within the newly-created parks, or for so long as they remained in the livestock business. In some instances, this assurance has been extended to include the life of any immediate member of the family — spouse, daughter or son.

Two phases of livestock pressure to increase grazing use of the national parks and monuments are a constantly recurring menace to the orderly and liberal plan outlined above. The first is a situation such as that occurring in each of the two World Wars. Under the guise of a national need for greater food production, those holding permits wanted to run more stock than their permits had called for in normal times. Coupled with that and using the same argument, other stockmen demanded that they be allowed to come into the parks and put their livestock on the "unused" meadows.

This is "emergency" pressure. It is caused by such factors as wartimes, drouth and **high prices.** During the past several years, we have had those pressures appear in combination, particularly in the California national parks.

In 1942 local grazing interests attempted to have national parks of California opened to grazing because of drouth, war and high prices. Similar pressures developed all over the country. In California, late spring rains nullified a lot of the "emergency." In 1944 the same pattern was repeated.

The 1944 patter of the stockmen is a bit succulent. They represented to Congress and federal officials that unless they were allowed to put their stock on the parks, they would have to slaughter their **purebred breeding stock.** It was that desperate! When concessions were made, the owners of purebred stock simply would not turn it out on wild range—it was on the hazardous side to let valuable animals run loose in such back country.

In 1948 — another emergency! Drouth. Appeals were made to the President, to Congress, and so on. Every dry spell seems to furnish an excuse for some stockmen to demand their livestock be allowed in national parks. There are quite a few dry spells. Weather conditions should not be a basis for abandoning the parks to cows and sheep.

The second phase of this grazing situation in national parks can be pointed up by two references. One is to the fact that in its original public admissions of objectives, the Joint Committee on Public Lands of the "land grab" attempt, outspokenly said that after it had succeeded in opening the way to buy Taylor lands, then forest lands, eventually some areas within the national parks and monuments, must be turned over to them—areas, they said, that never should have been included in the parks—areas that happened to have grass on them!

The other reference is merely to call attention to the fact that in 1948 the National Woolgrowers convention adopted a resolution stating that the national parks should be opened to grazing of domestic stock—that it would not interfere with the "privileged use" existing in the national parks!

Unfortunately, some grazing use does exist in the national parks; some as a matter of equity to operators who were grazing within their present boundaries before the parks were established, and some driven into the parks by pressure, under the "emergency" plea. That's "the foot in the door." And with the door cracked open, with **someone** getting a whack at the grazing in the parks, other stockmen demand equal bounty.

The fact is, that if every grassy area within the present national park system were opened to commercialization by grazing uses, it would add only 1/7 of 1% to the total grazing lands of the United States.

The continued grazing, under the permits existing as the parks were established, has damaged some park meadows and grasslands to the point where excessive erosion exists. The Park Service has had to take measures, in some cases, to heal up **this** damage to prevent **further** damage.

You can count on a certain type of livestock operator—a small number, it is true—to continue to look longingly upon any grass, national park or not, and to try to get his stock on it. The warning is clear in past performance.

PRIVATE HOLDINGS INSIDE NATIONAL PARKS

This merits mention; it merits action.

As the national parks were established, a number of private holdings already existed inside of the exterior boundaries. Laws creating the parks recognized the existing rights in these properties and provided these should not be modified by the creation of the park.

These properties were homesteads, patented mining claims and similar parcels that had passed into private ownership under our laws of land acquisition in unreserved areas.

Now these create problems. An owner can set up any sort of contraption on private property so long as it does not conflict with general laws. He could be stopped in launching a gambling joint where states prohibit gambling. But he could—and many have—put up a hot dog stand, plaster it with unsightly signs, right in the middle of a scenic wonder—even block public view of it. And he has a right to do so.

Many a private owner, fully appreciating the value of preserving park environment, has put up presentable and acceptable structures and operate enterprises not in conflict with park objectives. Many more have done the hurdy-gurdy thing.

There is need for ample appropriations to permit the National Park Service to purchase such private interior properties as disrupt the best use of the parks and shatter the qualities within them.

Joshua Tree National Monument

Local mining interests are exerting pressure to open the monument to mining. Previous exploration for gold uncovered some non-profitable deposits. There is one important iron ore deposit. Only seven of gold prospects are in the area of the monument where Joshua trees occur. In order to avoid wide-open monument prospecting, the National Park Service has agreed to reduction of the monument, realignment of boundaries, excluding some sections outside the Joshua tree forests. National Parks Association suggests that if this is done, additional acreage to compensate should be added, to preserve the short-leaf Joshua tree not now protected anywhere else.

WILDERNESS AREAS

There are three established wilderness areas which are seriously threatened. Each deserves more space than can be alloted. Briefly, these are specific threats, and they illustrate a general situation of threat to all wilderness areas as pressure on them, through other, unprotected, wilderness being obliterated, becomes greater.

THE BOB MARSHALL WILDERNESS AREA, Montana—This wilderness area, set aside as such in the Lewis & Clark National Forest, was the first reserve of this type established. It is high up on the Sun river, west of Great Falls, Mont., near the Continental Divide. As a wilderness area, its highest use was judged as being a part of unscarred natural America, to be kept from intrusion by man-made structures.

Both the Army Corps of Engineers and the Bureau of Reclamation have "interests" in the area. Mostly Reclamation. Reclamation envisages a dam, called Wilson dam, which would inundate a considerable part of the wilderness area. It would constitute a serious danger to big game range. This has not yet **come prominently into the open.** But plans are a-making and it may suddenly come forth, all blue-printed, budgeted and "fixed," ready for quick submission to Congress as "recommended."

Certainly, before this wilderness area is invaded by such a project, alternative dam sites should be considered—if, as, or when **needed.**

LAKE SOLITUDE—This is part of the "complete Missouri Basin" plan.

Lake Solitude is the central attraction in the Cloud Peak Wilderness area, Big Horn National Forest, in Wyoming. In its present serene natural state, it is a "sanctuary of solitude" far back in the Big Horn mountains, reached only by trails; a sky-mirror brooding in beauty amid massive mountains.

Reclamation proposes a road driving into this unviolated wilderness, a diversion dam down stream, and a dam that would turn natural Lake Solitude into a fluctuating reservoir, pumping works. **First** estimated at $370,000. In the first scheme water would be supplied to 2300 acres, supplementary water to 4500 acres, all in the Paint Rock creek valley, on the western side of the Big Horn range. **Present** estimated cost $1,500,000. Also revised is acreage to be benefited. Now it is expected **supplementary** water only will be available to only the 4500 acres.

The land to be benefited is owned by a handful of local residents. An economist for Reclamation testified at the Feb. 2, 1948, hearings on this project, that his people had gone into the Paintrock area and asked landowners how much they thought they could pay of the project cost. That's like the federal government putting up a factory for some manufacturer, then saying, "You set your price on a lease for the whole she-bang—we'll hang the rest of the cost on the taxpayers."

Here is a lake, near timberline, in an established wilderness area, the prized goal of many people who have traveled there or would travel there, which happens to have a physical aptitude for a dam being built across its face, a reservoir backed up over its natural basin—and wrecked forever. For the benefit of 4500 acres that would get "supplemental" water—for the benefit of a few owners.

The report is that proponents of the Solitude dam (those who would have land values increased while the cost of the project would be mostly charged against someone else), have said that the "conservationists protesting against the deal at the hearing have only slowed it up—they haven't stopped it."

The Lake Solitude proposal comes near to being one of the most unjustifiable "projects" that anyone could find was "engineeringly feasible" in the entire stretch of the Rockies.

Here's a stab at the heart of all the wilderness areas set aside in the nation—an outrageous proposition from every angle it might be approached, with the bill to be paid mostly by "someone" other than those "benefited" by water to supplement that already used on 4500 acres.

THE QUETICO-SUPERIOR INTERNATIONAL PEACE MEMORIAL FOREST

Between Lake Superior and the Rainiy Lake, in the wreckage of the old Mesabi mountains, is a tangle of lakes, streams and forests. This supreme lake country lies on both sides of the International Boundary. On the U. S. side is Superior National Forest; on the Canadian side is the Quetico Provincial Park.

As a piece of exceptional and unique America, this area stands above all others of its general type. In its way it is on a par with Yellowstone, or the Grand Canyon. Its charm lies in its wilderness qualities.

In 1921 two threats raised which would have obliterated the exceptional qualities of this area. One was a gigantic power proposal by private parties, which would have turned beautiful lakes into reservoirs—for private profit. The other was a projected forest road **system** which would have reduced this supreme canoe country to the level of the multitude of other lakes already reached by automotive transport.

Will O. Doolittle, then secretary of the American Institute of Park Executives, and Paul B. Riis, park superintendent at Rockford, Ill., formed the Superior National Forest Recreation Association, with the objective of halting these two menacing proposals. This association made the initial drive to keep this area as an outstanding waterway wilderness. The Izaak Walton League of America soon toook up the battle, carrying on as the association faltered, and this was followed by formation of the Quetico - Superior Council plus the cooperation of leading conservation organizations over the nation.

The power proposal was beaten back. The road plan was abandoned by the U. S. Forest Service as it recognized the values that could best be preserved by keeping a large part of the area roadless.

Through the constant efforts of conservation organizations, notable progress has been achieved.

Funds of the Izaak Walton League have been used to purchase plots of privately-owned lands at strategic points in the area; in some cases properties on which structures had been built. These are removed as properties are acquired, to allow the area to revert to wilderness. The 80th Congress passed the Ball-Thye bill (S. 1090), which carried authorization for an appropriation of $500,000 for "the purchase of land necessary to safeguard and consolidate certain areas in the Superior National Forest." A totally roadless area has been set aside on the U. S. side of the boundary. Canada has not yet moved so far forward in setting up preservation of the area north of the boundary, but this has been in part because of waiting to see if the U. S. would take necessary steps to preserve its side of this "Peace Memorial" project.

The program for private land purchase must be continued.

The most serious threat to wilderness values in this area now is the intrusion of the airplane. What is needed now is to establish whatever safeguards must be set up to hold this area for its natural, supreme use—the water-way type of travel. An executive order by the President can achieve this guarantee to maintain wilderness values.

FLAMBEAU RIVER, WISCONSIN

HISTORY — In 1947 a group of farmers near Ladysmith in northern Wisconsin applied to the state public service commission for a power dam for Dairyland Power Cooperative on the Flambeau river, just below Flambeau State Forest. A superb canoe stream near population centers and exceptional smallmouth bass fishing plus high scenic values would be irreparably damaged. Coincidentally, a bill in the state legislature proposed nullification of a state law which declared natural scenic beauties were the property of people of the state, and any developments altering such values would not be permitted.

The Wisconsin Conservation Commission and many conservation groups opposed the dam. The bitterness of opposition caused the Conservation Commission to withdraw objections. The legislature passed an amendment allowing **county commissioners** to **rule** on whether or not such a dam should be built.

Federal Power Commission has not yet granted permit for this dam according to our best information. This is the only hurdle proponents of flooding-damming have to get across to open the way for the project to go ahead. Project number is 1960. Russell Farley, Chief of Division of License Projects, Federal Power Commission, Washington, D. C., is the key man in action taken here. In Wisconsin, local opponents to this project face the problem of persuading the state legislature to repeal that amendment which allows county commissioners to decide on such a project which, in fact, involves the whole state and many interests beyond its borders.

The Black River Mess in New York

HISTORY—History of this strange and fabulous anti-conservation situation starts in 1885, when the people of New York established a forest preserve, followed in 1892 by creation of Adirondack Park. In 1894, by constitutional amendment, the state decreed that "the forest preserves, as now fixed by law, shall be forever kept as wild forest lands. They shall not be leased, sold or exchanged, or be taken by any corporation, public or private, nor shall timber thereon be sold, removed or destroyed . . . "

But special interests, in 1913, secured an amendment which permitted 3% of the lands to be used for construction and maintenance of reservoirs for municipal water supply, for canals, and to regulate the flow of streams. This amendment has two jokers. If the peaks and slopes of the reserve are eliminated, only 10% of the land is left—in bottom lands. So 3% of the **total** devoted to impoundings actually would mean a **third** of valley lands could be flooded. The other joker is that phrase allowing impoundings "to regulate the flow of streams."

During World War I, by successive steps, moves were made to provide for "river regulating districts," to be administered by a board of three members, which had to submit their proposals to the state Water Power and Control Commission, **but such a board could, in fact, disregard even recommendations of that state agency!**

Consistently since the formation of the Black River Board, its members have been officials of several paper companies which use power dependent on flow of the river. The whole history of its actions has been to use the public resources of the river to benefit corporations represented by the membership of this board.

This board, with the carefully-devised dictatorship over the Black river, now proposes to build Panther Mountain dam, which will smear up part of that forest preserve that the people have expected was to be kept inviolate. When the full import of how the power to do such an act lay in the hands of this self-interested board was realized, conservationists in the state, and many outside its borders, threw their weight in to stop the project.

Newspapers demanded halting of the project and curtailment of the board's powers. The Water Power Commission forthrightly admitted it could only **accept** or **modify** but not **reject** plans of the Black River Board; a confession that sharply accented the extreme power of that board to do as it willed. Forty thousand petition-signers in New York protested the raid on the Adirondack preserve. It became known that even the courts cannot review the behavior of the board unless public-spirited citizens put up many thousands of dollars as a bond, to bring court action.

The initial responsibility for rectifying a situation as grievous as this one lies with the people of New York state. But since a principle is involved, the moral support of others, and other aid to New Yorkers in fighting the crucial battle, may well be given by all conservationists.

Death on the Breeze

A subject that cannot be fully covered in this booklet, but which holds potentials as threatening as any, is the terrific expansion of the use of poisons to kill insects and weeds. Poison is poison and it kills. The trend to reach out to more lethal insecticides and herbicides means increasing danger of extending the death-blows beyond the immediate objectives of killing insects and weeds.

It is hardly necessary to point out that wholesale destruction of insects and weeds immediately changes environment on which other living things depend. The wiping-out of all weed types along borders of cultivated fields, the incident potential killing of plants not noxious as well, directly affects bird life that depends on the presence of such plants for food and shelter. The wholesale killing of insects not only blanks out food supply from that source for birds, but kills beneficial insects as well as those that do damage.

For instance, a poison spray that would kill the aphis would also kill their natural control by lady-bugs. The spraying of plants which require pollination by bees may kill the major actor in that essential process.

The poison-spraying of swampy waters to kill out mosquitos may kill other small organisms, which are the food of the forage fishes, which in turn are food for game fishes, and thus smash the "chain of life." The killing of water vegetation by sprays may remove the "pasture" for small organisms that are an initial link in that chain.

Experiment stations and some public agencies are laboring valiantly to determine the facts on what these deadly poisons may do as well as kill injurious insects and weeds. But the use is running like wild-fire ahead of knowledge of what these destructive forces may do to other forms of life.

Across the nation the potential of mass and indiscriminate poison-killing of many beneficial forms of life and wrecking environmental relationships **sets up one of the most frightening vistas in conservation fields.**

The use of such lethal practices as are potential in these powerful weed and insect poisons should be **thoroughly and cautiously controlled until all facts of their full impact are POSITIVELY established.**

That goes for poisons used against various types of predators, too.

A Page of Miscellaneous Problems

East Coast Fisheries—Depletion's one big problem. With admittedly little to go on, it appears from here that one need is for more fact finding, and another is application of such controls as are properly indicated by facts as they are determined.

West Coast Fisheries—The situation is similar to that of the East Coast, with the possible exception of the salmon industry. In the East the salmon is virtually gone from rivers of the United States; they linger in or have returned to only about four Maine streams, and even there not in commercial quantities. In the West the salmon faces dangers of severe depletion, if not extinction, because of current and impending barricading of streams, notably the Columbia, Rogue and others, including some in Alaska. Proper offshore fisheries control also is involved with regard to salmon, as with other species.

Great Lakes Fisheries—Numerous threats exist; one proposed solution is more stringent regulation of commercial fishing through agreement with Canada. The "convention" was actually signed by the two governments April 2, 1946, but it has not yet been ratified by Congress. Ohio interests have led the opposition, some technicians and others holding restrictions do not constitute the answer. Biological and ecological problems have a place in the scene; the intrusion of the sea lamprey is causing much present concern.

Unwise Drainage—This problem is nationwide. In far too many cases, history has shown widespread drainage for agricultural purposes has not paid out. The lands were not as fertile as pictured by promoters, or other damage or loss was caused. One of the chief losses is with regard to waterfowl and furbearers. The Putney Slough project, oultined elsewhere herein, is an example of an undesirable project. The Grand Marsh of the Kankakee, Ind., is now being restored after a long and costly struggle. Some of the main areas now threatened are in the Pacific Northwest. One is Malheur wildlife refuge in eastern Oregon. History has shown this is not susceptible to treatment as a subsistence farming region, yet some interests have sought so to convert a large part of it. In southern Oregon, in the vicinity of Klamath Falls, we are told the draglines are even now abroad in the land, methodically chewing their way across the earth—with what ultimate results no one has yet been able to guess.

Fakahatchee Slough, Florida—This, near Everglades National Park, is an area of mature cypress and royal palms in what technicians call a "climax association." Only about six sections of this virgin region remain uncut. Acquisition and preservation are highly desirable. Whether acquired by the federal government, or bought for preservation by the state or local interests, does not appear material, so long as it is done. This is mentioned only because similar small stands of mature climax forest types may yet be found in other areas if diligent search is made. Where is there left an appreciable stand of the majestic Georgia yellow pine, with its foot-long needles, to pleasure and enlighten generations of the future? How about such stands of typical mixed hardwood forests of the eastern portion of the country? We have a Save-The-Redwoods League operating to preserve the giant sequoia types of California and southern Oregon, and stands of some other typical western trees are secure within national parks and monuments, but isn't something of the same sort needed elsewhere? Someone might well take this up as a special project and pursue it.

Coastal Water Pollution—We have in mind such causes celebre as the National Lead Co. of New Jersey. In that case the company had so grossly polluted the already badly-abused Raritan river that the state of New Jersey rose in wrath. The company followed the expedient of dumping its wastes in the Atlantic off the Jersey coast. There appears to be a legitimate question of whether this single operation, already under way, will in itself do widespread damage to fishery resources important from both commercial and recreational standpoints. The Conservation Commission of the state of New York, the Izaak Walton League, and some other agencies and groups, have opposed the National Lead Co. dumping program as just another straw being heaped upon the camel. One concern is allowed to dump its wastes thus, and a thousand others in coastal areas claim the same privilege. Where does it stop, and in what condition do we ultimately find our coastal waters? A quarantine is established at our principal ports to prevent filth and disease from entering the continental United States; a quarantine against our sending filth and unpackaged death forth in increasingly potent doses upon rich offshore waters is also called for.

Antiquated Conservation Practices—Preservation and improvement of recreational resources, especially those having hunting and fishing value, cannot be considered static or fixed processes. Conservationists and sportsmen—those who expect to enjoy those resources, now or in the future — must keep step with the times. Technicians are constantly finding that methods and practices once considered excellent fall far short of perfection, may even be damaging, and certainly are wasteful of the license buyer's money. Wholesale fish stocking year after year is one practice on which fishery managers now cast a questioning eye. Artificial propagation and distribution of game birds and animals, without regard to habitat and its improvement, is another. Underfishing can be as detrimental as overfishing, in some waters. We hire experts, pay their salaries and for their research and investigations. We should at least be forward looking and open minded enough to listen to what they say they have discovered, and to give their proposals a fair chance. Likewise, it appears that too often the findings of qualified investigators are "received and filed" — in the nearest wastebasket or in some musty cabinet where they do nothing but gather dust. A dynamic program of investigation deserves an equally dynamic program of following up—on the lands and in the waters of our country.

Conservation Education — One of the most sadly neglected fields of conservation has been the education of the youth of the nation in its need. This should be taught in every elementary and secondary school—certainly in all the public schools. A central agency seeking to forward this movement is the National Committee on Policies in Conservation Education. It is broad in scope and membership, without partisan, sectarian or other limitations. As a matter of fact, its primary limitation to date has been in funds with which to carry on its projected activities. Conservation education needs to be encouraged and stimulated at many levels—in the public schools, in the teacher-training schools and colleges, need for "using without using up" and in every other way and place where the seeds of awareness of the our resources can be planted. It truly should be a program of action among our citizens from kindergarten to maturity.

THE MODOC CASE

HISTORY—The area involved is in the Modoc National Forest, the Warner mountains, northeastern California, near Alturas. The area is high plateau, grass type, thin, rocky soil, scattered juniper, ponderosa pine, brushy. Between 1870-1904, nomad sheep bands swept through, engulfing the range. About 1904, local ranchers asked that the area be included in national forests, to secure grazing regulation and protection against nomad sheep. In 1920 a similar request brought extension of the forest.

Not much spring range is available on public lands; local ranchers have turned stock on to the forest early, before the seasonal growth of forage is sufficiently advanced to supply adequate volume and topsoil protection. Some forest grazing seasons have started as early as mid-April. The basic need is for the ranchers to carry their stock an additional 15-30 days on feedlots and pastures outside forest. Repeated urgings of county agents and others to improve private holdings so this may be done have failed. Community is "back country," with an old-time outlook.

About 1940, the U.S.F.S. changed the opening of forest ranges in some cases from April 16 to May 1, in others from May 1 to May 16. What resembled an uprising resulted; one local forest man was practically run out of the community. Through pressures, the U.S.F.S. never was fully able to enforce this change. One large, influential stockman was so powerful he succeeded in preventing any change in his permit.

This also is one of the most important deer herd ranges of the Oregon-California border country; wildlife was blamed by stockmen for the over-grazed condition.

In 1947 trouble between the U. S. F. S. and Modoc cattlemen broke into the open; it apparently was stimulated by association officers as part of the campaign to discredit Forest Service administration.

The present trouble stems from the earlier grazing date allowed to the "big" cattlemen in 1940. Other stockmen say if he is to be allowed earlier use, they deserve it also. When the "big" operator heard his season was to be shortened in 1949, he declared he would fight it, and reportedly said the "next fight would be dirtier and harder than the last one." This "big" cattleman is a leading member of the Modoc National Forest Grazing Advisory Board.

The Modoc board did a resolution, too. It declared it was adopted in "open" meeting, but reliable information is that is was an "executive" session. As printed in the Alturas Plain Dealer and Modoc Times, Nov. 23, 1948, the resolution declared grievances against the U.S.F.S. as to length of season, numbers of livestock permitted, range carrying capacity, "proper" turning out dates in spring, transfer cuts, and others "too numerous to mention." It then resolved: "It is our opinion at this time that the administration of all the government controlled lands used for grazing within the Modoc National Forest be placed under the Grazing Service of the Bureau of Land Management." This move clearly was to dismember the forest and discredit the Service. Copies of this document were sent to The California Wool Growers Association, the California Cattlemen's Association, the National Livestock Association, the Joint Committee of the two National Livestock Associations (which is evidence that that committee still existed and functioned at that late date. See general statement on "Land Grab"), to Congressman Clair Engle, to the Department of Interior and the Bureau of Land Management.

At the **California** (state-wide) Cattlemen's Association convention in San Jose Dec. 3-4, 1948, Resolution No. 9, **adopted** (and published in December issue of California Cattleman), read:

"WHEREAS, the Modoc National Forest Grazing Advisory Board has unanimously asked that the management of all lands in the Modoc National Forest used for grazing be placed under the Bureau of Land Management,

"THEREFORE BE IT RESOLVED, that we urge the Secretaries of the U. S. Dept. of Interior and Dept. of Ariculture **to act on this immediately."**

NATURE AND STYLE OF THREAT—Here is another specific case history, typical of the genesis and pattern of the uproar of the few cattlemen to badger, bully-rag and be-devil the U. S. F. S. and discredit it. Here is one big cattle grower, who, because he will not accede to management of the range, even to his own benefit in the long run, who apparently got the local board to adopt a resolution, got it sent widespread, then got a supporting resolution through the state organization.

The cumulative effect of such actions, stemming from local power-drivers, is the core of the assault on the U. S. F. S. It is SO typical! With this kind of build-up that resolution will be cited as a "stockman grievance" against the U. S. F. S. At some time later it probably will be placed in the Congressional Record, and reprinted in stock journals across the nation.

The style and nature of the threat is that this, plus similar instances following the same pattern, cumulatively make a "case" which Congressman Engle and others, might give some credence. The essence of the situation is that one interest, intent on following a course that is anti-conservation, determinedly spreads the attack, enlisting support by methods indicated, and thus seriously undermines sound uses of our public properties, those who administer them and sets up a clamor which is repeated and magnified interminably. The demand for transfer of forest lands, voiced here, will be caught up and chorused by the "land grab clique" until it dins in many ears.

THE PRESENT STATUS—This, with similar actions by the few anti-conservation stockman interests, is part of the current movement to stack up "evidence" and feeling against the U.S.F.S. What may seem superficially to be a somewhat valid protest, if closely examined, often roots back to a U.S.F.S. official trying to keep one or a few stockmen in line as a fundamental requirement in carrying out responsibility for administering public properties on a sound basis.

THE CONSTRUCTIVE APPROACH—The U. S. F. S. has been put in charge of our National Forest properties to manage them so that the most value may be derived therefrom. Grazing is a secondary value. An insistence on the part of everyone, the citizen owners, that the government must be given solid backing—and rigid orders—to manage these lands for the best interests of all, is a paramount need. These managers of the forests are for the most part qualified, able, working for all of us for the good of all. The outcry of some individual, because he will not adjust himself to management that is imperative in the interest of all, must not ever be allowed to becloud the fact that these are our properties.

This is a case history, **but it is of national importance as such. A PRINCIPLE is involved.**

OTHER NATIONAL FOREST HOT SPOTS

"MINING CLAIMS"—As the National Forests were established, provision was made to allow prospecting and the staking of mining claims within their boundaries. When prospects were demonstrated as genuine mineral-producing locations, procedures were available for securing patent and title. This was in the legitimate interest of developing mineral resources. These statutes and regulations under them, have continued in force and presently prevail.

In the nature of prospecting, a legitimate filing of itself did not prove the presence of profitable minerals. That had to be explored. Nobody could tell in first stages whether there was a potential mine ahead, or merely a misleading indication there might be one. Therefore, the laws governing a mining location were and are very liberal. If a prospector thought he could find a mine, he could tear at it. Therefore, the situation is such that a locator can go into practically any area within the National Forests and stake a prospector's claim. He can live on it, mine on it, and if he produces anything resembling values, he can patent the property.

It should be remembered that this covers not only the lode mining, in hard rock, but placering along the valley streams.

An unscrupulous misuse of the rights and privileges of existing laws and practices has appeared in many western forests. In California, particularly, speculators have gone in and staked mining claims on recreational areas, in locations where roads are projected and along streams that are among the best angling waters in the state. They do not have to prove existence of economically productive minerals before locating; once located and doing their "assessment" work they are fortified in the laws, to defy any dispossession.

Lode claims can be as large as 600x1500 feet — 20.661 acres each. Placer claims are 20 acres for each unit. There is **no limitation** on the number a person may stake out! In one California case an individual located all land adjacent to a state highway, both sides, for 20 miles!

In quite a few spots, mining laws and procedures have been used as a tool by individuals to put them in a position to "shake down" or gouge the public.

Any changes made in the existing system should, of course, be intended for the long range protection of the public interest. The government now can reserve subsurface rights in disposing of surface acreage of public domain. Why not grant subsurface mineral rights to a specified tract, but reserve **surface** rights to the general public except for the approximate area required to work the claim efficiently?

Not sufficient attention appears to have been paid in the past to pollution questions involved in mineral operations on public lands. In case existing laws are not strong or specific enough to protect waters against pollution from mining operations on public lands, then support of the administering agency in seeking added strength may be desirable. Certainly prevention of pollution is a **progressive** and public spirited attitude.

Of utmost importance is the statement of a definite policy, by the Department of the Interior, or Congress if necessary, under which mineral leases would not be granted on any public lands without the prior consent of the federal agency having administrative responsibilities for such lands.

CONSOLIDATION OF LANDS WITHIN FORESTS—Law and regulations permit the U. S. Forest Service to exchange stumpage and/or lands for private holdings. One objective, for example, is to acquire cut-over private lands and put them into long-range management as part of entire forest units.

In addition, Congressional appropriations under the "Weeks Law" are set up to acquire by purchase, similar private lands which are desirable for acquisition to consolidate management and administration. The fiscal year of 1948 appropriation for this purpose was $750,000, a 70% decrease below the previous year.

Most exchanges are in western forests; most "Weeks" purchases are in eastern and southern forests. In the fiscal year past, exchanges in the West acquired approximately 331,000 acres, for which 308,000,000 board feet of timber and 48,000 acres were traded. Purchase under Weeks Act secured 431 tracts, 96,250 acres plus 7,240 additional acres under "Receipts Act," another law allowing purchase. All acquisitions under Weeks Act except 6,154 acres were in East-South. Net area of National Forests increased in year by 449,746 acres.

Partly as an element in the "land grab" propaganda and also stemming from other sources, there is a campaign moving to stop acquisition of these lands, even though owners wish to make sale or exchange. The "pitch" of this opposition is that "the greedy, bureaucratic government" must be stopped before it engulfs the nation; strangles "private enterprise." Also a part of this whispered opposition is that it "removes lands from tax rolls."

As to engulfing the nation, since acquisitions are inside of established forest boundaries, the limit is well defined as to extension of purchases. It is almost wholly consolidation within exterior boundaries; for better management and administration.

As to private enterprise, in most cases, it is the very element in the picture which makes the acquisition of these lands so important. Bad lumbering, "worn out" ranch or farm properties that have been so abused they no longer are farms (and never should have been thrown into that use), and similar "private enterprise" have made these lands uneconomical for private operation—but they are important in unification of forest areas.

Furthermore, a lot of private enterprise, varied and in volume, rests on operation of National Forests on sound basis. As underwriting of business, these areas are more productive as forest lands than deterioriating private property.

As to "loss of taxes," the propaganda against consolidation by exchange or purchase totally disregards the fact that every county is alloted outright 25% of the **gross** income from all uses of the forests, each county getting a share from each forest within it in proportion to the acreage of the forest in that county. The 25% of gross from forests generally is greater per area unit than any unit could produce in taxes if limited to one particular private enterprise use.

Futhermore, in addition to the 25% of gross income counties receive, 10% more is alloted under similar proportional assignment, for the improvement of roads and trails within forests of the county unit.

In addition, as these areas underwrite a volume of private enterprise (logging, resorts, grazing, etc.), there is a fortification of tax income from those private enterprises.

The "whispering campaign" against acquisition, and by it, consolidation of forest operations within exterior boundaries, has approached the stage where legislation is talked of, to stop this policy. It is opposition to sound conservation, basic need, and there should be sharp watch to note any move to upset the program of consolidating our National Forests into closer-knit, better operative units.

POLLUTION

To try to cover the gigantic field of pollution of waters within the space allotted in this booklet is an impossibility. It would be beyond our time and capacity even to try to detail representative case histories.

Every running stream and body of water adjacent to settlements, which means nearly every stream in the nation, has some kind and degree of pollution. The polluting materials are of three general types. One is domestic or municipal. The second is industrial, manufacturing or mining. The third is siltation as a result of erosion. All are destructive; all are important.

The 80th Congress enacted a weak law, Public Law 845. It has no teeth, except those inherent in an aroused public opinion. But it does do one thing: It firmly declares the eradication of pollution to be a national policy. One of its great weaknesses is that it offers a feeble hope of free federal money to municipalities for building sewage treatment works.

But there is no hope of sufficient money being appropriated to do a mass corrective job across the land. Probably not more than two or three towns and cities in any one state can hope for money help in any one year. The net result is that many city councils and other governing bodies will put in their bids for federal help, and then sit on their hands until that help comes through. Basically, any individual, any community, should be responsible for not unleashing filth to threaten others.

There appears to be a slow but general awakening of industrialists to the fact that they must do something toward treating the wastes their operations cause. Numerous large concerns are beginning to realize that they cannot face the adverse public reaction that would surely follow if they refused to do something corrective in the face of a federal public hearing—and such hearings ARE permitted under the new law. There certainly appears to be no question but that the vast majority of industrial wastes can be rendered harmless through known processes. The catch is that there sometimes is a question of whether the companies producing wastes can make money out of the known cleansing methods. Where this can be done, the industries often are willing to go ahead—although there are notable exceptions to the rule. They have been extremely slow, however, to recognize that cleaning up their messes is definitely a responsibility they must shoulder. Moral factors arise; so do rules of good social conduct. You don't dump your garbage on your neighbor's lawn and get away with it for long.

So—as to municipal and industrial pollution, the situation seems to be this: We have a law. It isn't perfect. At the same time it would be the height of folly to ask our federal lawmakers to strengthen it by amendment until it has had a chance to prove itself, one way or the other. Therefore, the proper course for conservationists seems to be to try to make the best of it for the time being. Work hard for better state laws. Enforce laws that apply and already exist. Use every possible means to prevent a delaying campaign by your local city fathers, and by states. Yes, states, because nearly everywhere we find state institutions that do not treat their wastes. Prisons, insane asylums and others dump raw sewage into the nearest streams. Work on state legislatures to bring about appropriation of adequate money for sewage treatment plants at their hospitals and other institutions. You can't expect a city or town to listen to warnings or demands from a state health authority if the state itself is an offender, can you? Get all possible done in your communities and states. Then, if the federal law is no good, let's think in terms of improving it **AFTER it has proved it is a failure, not BEFORE.**

An extremely important thing to remember is that today most communities have their storm and sanitary sewer systems tied together. Few sewage treatment plants can handle normal community wastes and the runoff from a heavy rain at the same time. Do all you can to get such connected systems separated, and to prevent new communities or subdivisions in the suburbs from having their storm and sanitary sewers hooked up together.

Another thing—when you learn of some industry that is finding new and better ways to treat its wastes, pass the word along to conservationists elsewhere, so they can talk to similar industries in their neighborhoods. In this way, and in many parallel ways, we can encourage improvement in waste disposal. We can encourage the existing interstate compact commissions to better results—and heaven knows that is desirable and needed. If those bodies don't produce, they can be strengthened or replaced by something else that will get the job done!

Now, about that silt. Erosion of soil is undoubtedly the greatest polluter we have in the United States today, in terms of volume. Improved farming and other land use practices are essential if we are to correct this. Not only does pollution from this source destroy or damage outdoor recreation and the fish producing capacity of our waters, but it also constantly and dangerously weakens our capacity to produce the food and fiber we must have for existence as a nation.

Pollution control is a national conservation crisis of the greatest importance. Conservationists, as the spearhead in the battle for clean waters, can do their country no greater service than to fight eternally against pollution.

IN CONCLUSION

The shortcomings and inadequacies of this booklet as an inclusive, fully-detailed guidebook to all spots of crisis in the conservation field is fully recognized. Some of the most threatening situations in the field of conservation undoubtedly have not been included. Others that merit far more space have been condensed more than should be.

If, however, this can be taken as a beginning, bringing a number of serious situations before you, it will have fulfilled, in some measure, the need for such a reference pamphlet. It is a start. It may well point the way to an extension of such information service as future aid in an expanded form. There may be foundation here for a number of organizations to join effort, to carry on more adequately.

The consideration of a plan which will do fully what we have attempted to do here in part, is most strongly urged. There can be no question whatever, that some basic reference of this general pattern is a crying need. The response we have had to the idea as we suggested it, proves that need without any chance of doubt. Before anyone can move to guard against threats and dangers, they must know what is involved; the nature of those threats and dangers. Then, with the splendid reporting service of current changes that several national organizations already supply, people can act intelligently and swiftly, as needs develop, as the situations change.

This, then, must be considered as a bit of trail-blazing. As such we hope it has marked out a path to be followed.

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TECHNICAL COMMUNICATION No. 43

LAND CLASSIFICATION

FOR LAND-USE PLANNING

by

G. V. JACKS

Price, 4*s*. 0*d*.

(Published by the Imperial Bureau of Soil Science, Harpenden, England)

1946

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LAND CLASSIFICATION

FOR LAND-USE PLANNING

Land Classification and Land-use Planning

Land classification in the sense here used relates to the grouping of lands according to their suitability for producing plants of economic importance. Such land classification must form the starting point of land-use planning, which is very much in vogue at present, although few land-use plans based on systematic land classification have been put into operation. As we shall see, there is no sharp distinction between land classification and land-use planning, and sometimes it is necessary or convenient to initiate a plan before a classification is made. Land classifications group lands according to their native characteristics, present use, yield capacity and so on [6], and these classes are then assessed with reference to their suitability for the different uses contemplated in the plan. Classification for land-use planning may be purely qualitative—lands being classed according to their suitability for different kinds of use rather than according to their inherent or man-made productivity—or quantitative, when estimates are made of the relative productivities of different classes of land under definite uses.

A land classification for planning purposes must be related to the objective of the plan. "The foremost essential in a possible list of Essential Elements in Land Classification" wrote Schoenmann [75] "should be a clear and complete definition of why the proposed classification is needed and how it will be used when completed." "The first requirement for the successful development and application of any technical system of land classification" wrote Kellogg [45] "is a clear understanding of the problems for which the classification is needed." According to such statements it might be concluded that no general principles of land classification can be propounded, and that every land-use plan requires an *ad hoc* classification.

It can, however, be stated that every land-use plan—except, perhaps, in countries fully developed economically and socially—for exploiting the agricultural and forest resources of a region for the lasting benefit of the occupiers must be based on the conservation of soil fertility. Plans can, of course, be made for the rapid exploitation of the capital resources of the land, but even under the stress of war none has been proposed with this objective. It may be assumed that nearly all the kinds of land-use plan with which we are here concerned have a common primary objective—soil conservation. They may have very different secondary objectives relating to the ways in which the land can be exploited for the benefit of the occupiers, but these secondary objectives are dependent on the attainment of the common primary objective.

The United Nations Conference on Food and Agriculture that sat at Hot Springs, Virginia, in 1943 made certain recommendations for the long-term organization of agriculture that may be taken to reflect the common aspirations of land-use planners everywhere [92]. The Conference recommended, *inter alia* :

(a) that the inherent natural and economic advantages of any area should determine the farming systems adopted and the commodities produced in that area ;

(b) that farming systems should be so designed as :

(i) to maintain soil fertility at levels which will sustain yields and ensure adequate return for labour ;

(ii) to protect crops and livestock from major pests and diseases ;

(iii) to favour steady employment throughout the year ;

(these three ends, in general and save in exceptional circumstances, can best be assured by balanced mixed rotational farming and by avoidance of single-crop production, or monoculture ;)

(c) that production of nutritionally desirable foods which can be obtained from elsewhere only with difficulty or not at all is a special obligation of the agriculture of every country ;

(d) that in every region subject to drought (occasional or in the form of sharply marked periodic dry seasons) suitable measures should be undertaken, partly by storage and partly by diversification of production and development of water resources and cultural practices ;

(e) that land used or likely to be required for agriculture should be protected from erosion ;

(f) that the spread of existing knowledge by education and the development of new knowledge by research should be constantly promoted, and that in these matters nations can co-operate to great advantage.

Nearly every objective in this list requires, directly or indirectly, the maintenance of soil fertility. In one region the emphasis will be on, say, the control of erosion, in another on the maintenance of continuous employment, but the different aspects are interdependent ; steady employment helps to sustain the public interest without which soil-conservation measures are likely to fail in their purpose. The planner and land classifier, however, will usually concentrate on the predominant factor in land utilization, but will not forget the others.

The purpose of land classification for land-use planning has been described as to determine " the types of production, use and service that can be obtained from the land that will yield the highest social and economic benefits to the people dependent thereon " [12], or " the uses of land that are the best for all of us together, that is, for the general public " [6]. Its function is to present " the best known facts about land use that in turn would be of assistance to the people on the land in making decisions for themselves " [12]. It matters little what social, economic or political goal the planner has in view. In the United States land-use plans are made on the assumption that they will operate in an individualistic, competitive

society, in Russia on the assumption that they will operate in a state-controlled, communistic society. In each case a different path must be trodden to reach the desired goal, but whatever the form of society aimed at, the land must be used in such a way that its fertility is at least maintained, for no form of stable society can persist long in a deteriorating environment. Land classes for land-use planning purposes, therefore, must be distinguished primarily by the different uses to which they can be put without losing, or by the different measures which must be taken to conserve, their fertility. Soil conservation is the physical objective of all agricultural land-use planning, and provides a common basis for the formulation of certain general principles of land classification. Every land-use plan is essentially a measure of soil conservation. When it is nothing else the corresponding land classification is comparatively simple, for the criteria for distinguishing land classes are merely the characteristics significant for soil fertility ; but when the land-use plan has, as is usual, some other specific object such as the production of a certain crop, regional self-sufficiency, the liquidation of debt, the development and use of water power, the establishment of commercial farming, or what you will, then a special *ad hoc* system of land classification has to be devised for each objective, and no general principles can be laid down.

Land classification for land-use planning is therefore based primarily on soil-fertility characteristics, and secondarily on whatever characteristics of the land are significant to the specific objective of the plan. For example, the specific objective might be to develop a perishable crop which requires immediate transport to the consumer. Here roads and railways would be important characteristics in land classification, but the basal classification would still be a fertility classification indicating which areas would safely and successfully produce the crop in question, and which should be devoted to alternative uses. There is no relationship between the two sets of characteristics—the physical, chemical and biological properties of the land on the one hand, and the available transport facilities on the other. Two (in many actual cases, several) distinct classifications are involved which have to be combined into one. This is one of the main reasons for the indefiniteness of many land classifications ; they are compounds of several which are not necessarily interrelated.

It is usual to distinguish between the physical, and the economic and social, classification of land. Kellogg and Ableiter [46] and many others insist that the physical must be considered quite separately from the economic and social characteristics of land. The physical or " inherent " characteristics include the geology, climate and topography and are permanent in the sense that they cannot be profoundly altered by man. Geology, climate and topography are combined in the factor soil which, though to some extent modifiable by man or other living organisms, is the main factor in a physical classification. A physical land classification is permanent, and once made can serve as the basis on which to superimpose an economic and social classification which will need to be modified with

changes in economic and social conditions (e.g., market conditions and communications) as well as with the changes in the objective of the plan that may occur as the plan unfolds. Soil fertility, however, as distinct from the separate physical factors that comprise soil, is not immutable. Man can easily change the level of fertility up or down, but whether or not he does so is determined mainly by economic factors. In theory, every soil can be brought by appropriate measures to the optimal state of fertility, but in practice the application of the required measures is often limited by economic factors. The Sahara could be made fertile by irrigation and manuring, but it would not pay. Chemically and physically poor sandy soils might be classed as suitable for intensive market gardening if favourably situated with regard to markets and supplies of manure, but quite unsuitable if market facilities were poor or costs of manure were high. The significance of these factors will vary continuously with the social and economic development of the country or region.

Soil fertility thus has as much claim to be considered an economic as a physical characteristic of land.

Much of the work on land classification has been carried out by economists. As we are writing primarily for the agriculturist we shall approach the subject more from the agricultural than from the economic standpoint, but it is important to recognize that the determination in practice of optimal land use is essentially an economic problem. In the last analysis the success of any land-use plan depends on its economic soundness. Gray and Regan [27], writing as economists, state that: "Land classification is aimed at determination of economic best use from both the entrepreneurial and the social standpoints; although the best use of land does not imply ignoring the best use of the other factors of production.

"An important task in land classification is determining the advisability of the advance, the continuance, or the retreat of agriculture—or in conventional terms, the location of the extensive margin of cultivation;—for the one or the other of these trends has important implications with respect to institutional patterns, capital and debt structure, public finance, and numerous other considerations."

Astor and Rowntree [4] distinguish between the optimum and maximum fertility level of an agricultural soil. Optimum fertility levels are determined by the ratio between input (i.e., total costs of production) and output (i.e., total sales). They vary not only between one crop and another, and one soil type and another, but also between the same crops and soils in different localities. Maximum fertility is determined simply by yield, either yield per plant or yield per acre, and the weight of the crop is not always as important as the quality.

The factors to be taken into account in an economic and social classification will vary both as to their nature and the weight to be attached to each, with the social objective of the plan. In some instances markets, in others communications, in others tradition and custom, in others political

questions may constitute the dominant factor, and there will always be many variable and fluctuating subsidiary factors. Veatch [97] includes among the essential economic data uses of land, kind of ownership, land values, transportation facilities and markets for present and potential products; and among social data, distribution and kind of population, both rural and urban, and economic status (standard of living) of rural classes. Allin [3] includes among the land-use factors which must be taken into consideration in America " such things as the passing of the physical frontier, the change of this nation from a debtor to a creditor status, the loss of foreign markets, the approach to a stable population, and the evident conflicts that have arisen in our economy between capital and labor." By its very nature social-economic land classification must be labile and indefinite.

In undeveloped country where the social factor has not operated appreciably, a physical land classification is applicable without great modification to land-use planning. Indeed, the purpose of land-use planning in such countries is to avoid the costly trial-and-error process of crop adaptation that has hitherto prevailed. The idea is, instead of planting a crop on inferior land because it is near a railway, to plant it on the most suitable land and then bring the railway to it. In long-settled countries the social-economic factor tends to predominate in land-use planning. Land use has largely adapted itself in the course of time to the physical environment, and any planning that may be thought necessary is concerned mainly with adjustments to changed social and economic conditions.

A land-use or " use-capability " classification, if it is to have permanent or long-term validity, should also allow for probable developments in technique and science, e.g., the production of frost-resistant crop varieties, new kinds and sources of fertilizer, new methods of cultivation [25]. Land in England that until recently was commonly regarded on account of its heavy texture as permanent-pasture land proved itself during the war to be first-class arable land easily cultivable by modern machinery. But although a classification should allow for such developments they cannot, of course, usually be foreseen.

It is, in fact, impossible to forecast with any accuracy either economic or scientific developments, and a practical land classification which takes them into account must necessarily be vague. " There is ample evidence " writes Hudson [39] " that the end product of land classification consists largely of ascertaining trends in land use within definite areas and that the function of land-use planning agencies is to facilitate and direct these trends towards a definite goal rather than to impose some preconceived land-use plan. The goal towards which land-use trends is guided is . . . ' the utilization of lands for their greatest value'."

The nature of land-use planning is described by Lilienthal, writing of the T.V.A. plan to develop the land and resources of the Tennessee Basin [49].

> In the unified development of resources there is such a Great Plan: the Unity of Nature and Mankind. Under such a Plan in our valley we move forward. True, it is but a step at a time. But we assume responsibility not simply for the little advance we

make each day, but for that vast and all-pervasive end and purpose of all our labors, the material well-being of all men and the opportunity for them to build for themselves spiritual strength . . . .

Not one goal, but a direction. Not one plan, once and for all, but *the conscious selection by the people of successive plans.* It was Whitman the democrat who warned that " the goal that was named cannot be countermanded."

If this conception of planning is sound, as I believe, then it is plain that in a democracy we always must rest our plans upon "here and now," upon "things as they are." How many are the bloody casualties of liberal efforts to improve the lot of man, how bitter the lost ground and disillusionment because of failure to understand so simple and yet so vital an issue of human strategy. So frequently have men sought an escape from the long task of education, the often prosaic day-by-day steps to "do something about it," by pressing for a plan—usually in the form of a law—without considering whether the people understand the reason for the law's plan, or how they are to benefit by it.

An unwillingness to start from where you are ranks as a fallacy of historic proportions ; present-day planning, anywhere in the world for that matter, will fall into the same pit if it makes the same gigantic error. It is because the lesson of the past seems to me so clear on this score, because the nature of man so definitely confirms it, that there has been this perhaps tiresome repetition throughout this record : the people must be in on the planning ; their existing institutions must be made part of it ; self-education of the citizenry is more important than specific projects or physical changes.

The points made by Lilienthal are worth emphasizing. Firstly, that a land-use plan is dynamic ; it changes as it unfolds. We can see the goal—the highest attainable level of fertility—but we are lucky if we can see more than one step forward at a time. Secondly, that the people must play as intimate a part in the execution of the plan as the crops and animals they tend. This is a political matter ; a people controlled by an autocrat is a more pliant agent in executing a plan than a nation of individualists. Thirdly, that the present state of society should determine the next step forward. Here again, an autocracy can take greater liberties than a democracy, but whatever the polity an appreciation of the facts of human ecology is essential.

There are not enough examples of successful land-use plans to enable us to dogmatize upon whether " the people must be in on the planning ", but the evidence available—mainly from the United States—indicates that the active, as distinct from the passive, participation of the people in all the operations can be a decisive factor in assuring success. If the people are to participate actively they must understand what is being planned, and they must understand the land classification on which the plan is based. Several writers have stressed the importance of having a system of land classification that is crystal-clear to the ordinary layman. Such a system is not likely always to satisfy the taxonomic pundits ; but from the practical standpoint more is usually gained than lost by using a classification which does not need, and sometimes will not bear, thinking about. A unique feature of land-use planning is that the people not only make and execute the plan, but themselves constitute one of the chief things to be planned.

Gross [28], in an analysis of the failure of the nation-wide county land-planning programme launched in the United States in 1938 by the

Mount Weather Agreement, attributed failure in the first place to the fact that no desire to solve community and county problems was created in the population of the areas in which the planning programmes were to function. " Experts can work out beautiful expositions of problems, they can present exclusively alternate solutions, but unless a self-interest to achieve these results is established, the expensive work of the expert has little or no value." In Gross's opinion the prime task of the land planner is not to solve certain immediate problems, but to develop a community determination to solve them. It is a task which the experts in geography, agriculture, soils, economics and so on are not always qualified to perform. If county land planning recovers from its present demise the specialist in a future planning organization " should be made cognizant of his purely advisory capacity."

That land-use planning is essentially an exercise in human geography is obvious. It is an exercise to the performance of which many non-geographical sciences have much to contribute, but the approach to it must remain geographical. Colby [16] distinguishes four phases of the land-planning process (1) survey and classification, (2) appraisal, (3) design, and (4) effectuation, and gives the following description, taken verbatim from his paper, of a geographer's approach to it.

> The survey and classification phase of land planning calls for a critical examination of the occupance pattern as it is to-day. For this work, the topographic and other customary maps and the census and other statistical materials are useful, but they do not deal with all of the features and conditions which in association make up the occupance pattern. Such maps and materials, moreover, are not sufficiently detailed, for as McMurry has pointed out, "as soon as land planning work leaves the theoretical plane, and the problems assume practical application minute detail is essential." Land planning requires an analysis in map and other forms which distinguishes the component elements in any part of the occupance pattern separately or in their relation to the whole. Fortunately, two recent advances in technique make this practical. Aerial mosaics, the great contribution of air photography to mapping, provide the base. Site analyses, recorded in the fractional code, an analytical technique developed co-operatively by geographers in the last decade, furnish the primary materials. When once these materials are in hand classification of the associated elements or of any individual elements becomes possible.
>
> Detailed site analysis has the disadvantage of being too slow and costly for many types of land planning. In attempting to solve this problem, experiments have been tried with the sampling method, the traverse method, and the unit-area classification. In the sampling method, sample surveys are made at either planned or random intervals. In the traverse method, the surveys follow lines or strips across the area under examination. Both of these methods involve perplexing statistical questions. The unit-area type of work contains an element of classification as well as analysis. For the writer, the idea of unit-area classification carries back to a field conference in 1925. At that time I became hopeful that we might be able to perfect a technique by which one could recognize the entity of any point or area and then map that entity as far as it extended. The idea was tried out in rapid traverse work over long distances with some success and was reported at a meeting of the Illinois Academy of Science in 1933. In the past year further experiments with the method were set up but the results were unsatisfactory until the problem was allocated to the geography section of the Tennessee Valley Authority. After some experimentation, the men of this section learned how to combine the idea with the aerial mosaic—site analysis technique. The site was widened to an

appropriate area, classification was added to the analysis and the unit-area type of land classification became a reality.*

The second phase of land planning calls for an appraisal of the occupance pattern in order to discover its points of strength and its points of weakness. This involves a study of the spacing of individual elements in the pattern and the relation of each individual pattern to the composite pattern. It also demands that proposals for changes in any individual pattern be weighed as to the probable effect on other individual patterns and on the composite pattern. The ramifications of this type of work are many. It leads to investigations of the assets and liabilities of any area for particular uses. It asks if particular sites are deteriorating under use, and if so how rapidly. It implies analyses of slope and soils of a new degree of intensity. It calls for much greater knowledge of climates of slopes and thermal belts than we have at present. In this connection practical experience is placing in action some of the investigations advocated by the Mississippi Valley Committee, or by the Land Use Committee of the Science Advisory Board. This phase of land planning also studies the adjustment or cultural features to natural features, seeking areas or points of satisfactory or of unsatisfactory adjustment. Finally, land planning raises the all-important question as to whether or not the occupance pattern in its present status serves and promotes the physical and social welfare of society. Many of these questions call for painstaking research on the part of geographers or other scientists. Some call for evaluation by men of long experience in business. Land planning does not care who does the work, but it does care greatly for the results.

The third phase of the planning process is that of design or active planning for the attainment of stated objectives. In land planning this means the formulation of a design for the development of a progressively better occupance pattern. Design begins with a preliminary intellectual conception of something to be done or produced. It implies a penetrating knowledge of the existing occupance pattern and a full understanding of the objectives to be attained. In the acquisition of this knowledge, geography, as we have seen, plays a highly important part. It may be assumed, and we have some evidence to support the assumption, that the momentum of understanding gained by geographers during the survey, classification, and appraisal phases will enable them to make valuable contributions in the formulation of the design. Purposive planning, after all, may be thought of as the formulation and prediction stage of a sequence of scientific exploration. In land planning the sequence includes observation, analysis, classification, appraisal, formulation and prediction. Geography, with its contributions to the early stages of the process, may be expected to contribute significantly in the later stages.

Land planning by its very nature may be expected to introduce a rational element into social planning. Land planning, like geography, insists on the areal concept. It demands that the social structure be held in its physical setting. It strikes at reality and tends to hold reasoning within a rational frame of reference. It is the intelligent application of the principles of geographical science and other sciences to the problems and interests of society.

In the final phase of the planning process, that of effectuation, geographical science has, as far as I can see, little or nothing to offer. The question of putting plans into effect is a matter of administration and rests on the interest and desire of the general public. The men who administer planning programs need not be scientists ; in fact, it is better if they are not interested in promoting a particular science. They do need to be, however, administrative artists in applying the findings of science to the solution of problems of public welfare.

The best known and probably the most successful land-use plans in operation are those of the American soil-conservation districts. In July, 1945, 3,404,000 farms covering 734 million acres were included in the 1,328 soil-conservation districts which had then been set up [78]. The prime objective of every soil-conservation-district plan is the same—to save the

* See p. 47.

soil from exhaustion and erosion. Quite a simple physical classification, defining land in terms of its erodibility, suffices as the basis of the plans (see p. 42). Social and economic factors do not enter into the land classification, but they do enter into the effectuation of the plan, and may necessitate modifications in the " ideal " plan based on strict adherence to the physical land classification. The plans are made and carried out by the occupiers of the land themselves who can call upon outside experts to give advice and direction, if required.

Bennett [8] states that the guiding principle of the Soil Conservation Service in planning land use has always been that the effective prevention and control of soil erosion and the adequate conservation of rainfall require the use and treatment of the various kinds of land, each according to its special needs and capabilities.

In applying this general rule, however, it must be borne in mind, firstly, that the use and treatment of any land are determined not only by physical characteristics, but also by such factors as available facilities—implements, power, labour, finance—and the preferences, skill and intelligence of the occupier. The occupier, as well as his land, may require " treatment".

Secondly, each parcel of land has to be considered in its physical relation to adjoining land ; optimal use of high-lying land may be determined as much by the use of the lower-lying land as by its own physical characteristics.

Other examples of land-use planning according to a land classification are afforded by some Russian collective farms (kolkhozes). These plans have to fit in with the larger production plans of wide regions that in turn are co-ordinated into a national plan by the central planning authority (Gosplan). The kolkhoz is required to produce certain amounts of certain crops, and is expected to adopt certain rotations and farming practices which have been shown to conserve soil fertility in the region concerned. A fair amount of freedom in land use is permitted, but the general framework of farm management is predetermined. Under such circumstances a physical land classification to suit the preconceived plan, which may be modified within limits to fit the land classes, can readily be made. Social and economic factors enter to a variable, but usually only to a minor, extent.

Both the soil-conservation districts and the kolkhozes represent particularly straightforward examples of land-use planning because the objectives are clearly defined and are definable directly in terms of land use. Where the objective is less clear, or less clearly related to definite uses of land, the land classification tends to be correspondingly vague. An objective such as the common welfare, the public good, the improvement of the standard of living, or merely the optimal utilization of the land forms an insufficient basis for a land classification ; it is necessary to state how the objective is to be attained—for example, by an economy based on cocoa, sugar, mixed farming, etc. The Scott Committee on Land Utilization in Rural Areas [57] was instructed to consider the planning of post-war England and Wales.

It assumed* that English agriculture would be characterized by a continuance of the "traditional" type of English farming (balanced, mixed farming with small, individually owned farms predominating), and on this assumption recommended as a basis for land planning the adoption of the classification of the Land Utilization Survey (p. 57) that distinguishes classes according to former use under the traditional system. Here the relationship between the system of land classification and the means by which the planning objective is to be attained is obvious. If an entirely new system of agriculture had been proposed, a classification according to former use would not have been appropriate.

For land-use planning, therefore, there is a very close connexion between the objective of the plan, the means proposed to attain it, and the appropriate system of land classification. There is no such thing as a general land classification, but there is a common physical classification appropriate as a basis for all land-use plans aiming to promote and perpetuate the public welfare, and therefore requiring the maintenance of soil fertility. Superimposed on this basis is another social-economic classification which is, in effect, part classification and part planning. It is often difficult to know where the process of land classification ends, and that of land planning begins.

Types of Land Classification

The Land Committee of the United States National Resources Planning Board, in its *Report on Land Classification in the United States* [62], distinguishes five types of land classification at present in use. These types are not fixed or exclusive; many of the land-classification projects mentioned in the Report can be assigned to two or more types. But while the types are somewhat arbitrarily defined to suit the special circumstances of contemporary land classification in the United States recognition of them brings out the general fact of the dependence of land classification on the use which is to be made of the system. The five types are:—

Type I. Land classification in terms of inherent characteristics.
Type II. Land classification in terms of present use.
Type III. Land classification in terms of use capabilities.
Type IV. Land classification in terms of recommended use.
Type V. Land classification in terms of programme effectuation.

Of the 75 miscellaneous projects analysed in the Report, 68 are of, or include, type-I classification. We have already referred to this type as a physical classification. It is the least dependent on the use to be made of the classification and is, moreover, almost essential to the further development of any practical classification of land for agricultural or forest use. The inherent characteristics to which most attention is usually paid are soils and topography, though other natural land qualities assume equal or greater importance in special cases (e.g., subsoil and water table in irrigation

* Majority Report. A Minority Report by Prof. S. R. Dennison makes rather different recommendations.

planning). Land classification according to inherent characteristics must obviously be the fundamental classification in undeveloped or partly developed regions where man-made qualities such as present land use, urbanization, political and economic factors, etc. have minor significance.

Type-II classification, according to present use, may also be considered as "fundamental", at any rate in long-settled regions where sufficient time has elapsed for both the inherent and the man-made qualities of the land to have reached an equilibrium as regards their influences on land use. The classification of the Land Utilization Survey of England and Wales (p. 57) is a type-II classification, and as such is applicable to a plan which aims to rationalize rather than to change the time-tested, traditional system of land use. The Land Utilization Survey originally defined its classes solely in terms of present use and made no claims for the system as a land-planning tool. Later, the purely type-II classification was expanded for planning purposes into type IV (recommended-use classes).

Both type-I and type-II classifications are essentially inventories of actual conditions. They take no account of potentialities. The modern American soil survey, which is evolving into a land classification, is a combination of types I and II with a recent admixture of type III (use capability).

For type III a specified use is assumed (e.g., cereal culture, pasture, forest), and land is assessed according to its potential productivity in that use. First-rate forest land may be fourth-rate cereal land. For crop use, land may be assessed according to the estimated yield of the crop under a given system of management that may be based on the average, optimal or any other standard. The system of management can be a determining factor in the classification. For example, land might be classed as high-yielding under dry farming owing to excellent water-holding characteristics, and as low-yielding under irrigation owing to defective drainage. In forestry, the classification of site quality according to actual production or according to production estimated from the nature of the vegetation is an example of type III.

An alternative form of type-III classification is according to the measures which must be taken to bring the land to a certain standard condition, e.g., immunity from erosion. This form is much used in the U.S. soil-conservation surveys. The knowledge required for a type-III classification always includes much of that which is obtained in making a type-I classification.

Type-IV classification (in terms of recommended use) is in effect a combination of the preceding types. It is not so much an actual classification of land as the formulation of a land-use plan on the basis of the inherent properties, present use and capabilities of the land. The same is true of type V—land classification in terms of programme effectuation—which involves indicating on a map the different stages and methods whereby land-use recommendations are to be carried out. Both in type IV and type V complex political and social questions such as the form of govern-

ment, the aspirations of the community, the legal power of the planning authority and the rights of landowners are involved. The five types represent a series of increasing complexity and afford a good illustration of the way in which land classification, starting in its simplest and most fundamental form as a soil classification, may become merged into land planning without any sharp distinction between them.

The Physical Classification of Land

In a posthumously published and, unfortunately, unfinished paper C. F. Marbut [53] makes a clear distinction between a " natural " and an " economic " classification of land:—

> In the broadest sense possible the classification of lands may be considered from two points of view. In one, lands are considered as natural bodies, are differentiated into units and the latter arranged into classes on the basis of inherent natural characteristics. Such a classification has no necessary relationships to man or his institutions. The other classification, however, has a definite relationship to man. It may be called an economic classification. It is a classification based definitely on the relationship of different kinds of land to man and his industries. In the first case, in the physical classification, the units are being defined on the basis of definite character, and express therefore essential and inherent, permanent characteristics. In the second case, or the economic classification, being based on a relationship that varies with the status of man and his institutions at any given time, the classification is not permanent. The definition of land units for the same parts of the earth's surface differs from time to time, depending on the changes regarding man and his institutions in a given spot at any particular time. The lack of permanence is due to the changing character of man's institutions, not to changes in the inherent characteristics of lands.

Marbut asserts that land may be used by man in three main ways :

(1) as mere areas of solid earth on which to live ;
(2) as areas varying in desirability because of relationships to other kinds of land, or to man and his institutions ;
(3) as sources of usable material.

As we are here only concerned with land use for plant production our land classifications are not concerned with the first two uses, and need be related only to those characteristics of land which determine the kind and amount of plants produced. As a basis for such a classification Marbut proposes the following definition of land. *Land is a term connoting all the features of man's natural geographical environment with which he deals in crop production.*

Marbut proceeds to establish the bases for a classification according to the permanent physical properties of land that are significant in plant production. Such a classification is the equivalent of a potential land-use classification, lands being grouped according to their physical capacity for producing different kinds of plants, regardless of whatever use is or has been made of them. " No attempt has been made to determine the kinds of land here discussed by any sort of indirect approach such as the type and apparent success of the local agriculture, the kinds of crops grown or the yields obtained or the character of the natural vegetation. Such an approach to the problem is consciously avoided because the essential

character of a physical classification requires a direct approach through physical character. It is well known and generally agreed by students that such indirect methods may give certain definite results. It is possible to identify ' good ' or productive land by a study of the character of the natural vegetation growing on it or that grew on it. It is equally possible to arrive at the same conclusion through a study of the existing agriculture. Notwithstanding this possibility a serious objection to such methods lies first in the fact that the result obtained is wholly empirical and neither the facts nor the conclusion presents the possibility of drawing any other conclusion than that the land is productive for the plants grown."

On the other hand, a classification based on inherent physical characteristics provides a basis for drawing conclusions regarding the use of land for more than one purpose.

The most important of the " features of man's geographical environment with which he deals in crop production " are soil and climate, these constituting the main part of the physical environment in which plants grow.

On the plant side the two main factors to be considered are (1) adaptability to, and (2) productivity in, the environment. It is well known that certain plants attain their optimal development in certain regions (e.g., corn in the Corn Belt in the U.S.A.), whereas in other regions owing to the presence of some limiting factor such as too short a growing season, too much or too little moisture, too hot or too cold a temperature, growth is partially or completely inhibited. The factors influencing adaptability are mainly, but not entirely, climatic. Within any one, more or less homogeneous adaptability or climatic region, however, great variations in productivity for a given crop may occur, associated mainly, but not entirely, with variations in the soil factor. Variability of productivity is greatest in regions of optimal adaptability where the possible range of production per unit land area is from zero to the maximum known. In the so-called marginal zones soil or productivity factors are less significant.

A third factor unrelated to adaptability or productivity that has to be considered is accessibility—not to markets, since this is a purely physical classification, but for agriculture. Accessibility concerns mainly the relief of a region. Some lands, for example, are too steep, or have too broken a topography for crop production, even though the climatic and soil conditions are favourable, because of difficulties of cultivation or the hazards of erosion. Accessibility in this sense is less a limiting factor in forestry than in agriculture.

The physical land characteristics significant in plant production may thus be grouped as (1) those which control the kinds of plants grown (mainly climate), (2) those which control the productivity of the land for the plants grown (mainly soil), and (3) those which determine the accessibility of the land for crop production (mainly topography). It will be seen that the proposed classification, though physical, is expressed in agronomic terms—in terms of the significance of the physical characteristics for agriculture.

It is not at present possible, owing to our inability to assess quantitatively the agricultural significance of physical factors, to make more than a very general classification of land on this basis. Marbut's proposals appear to involve a first differentiation of lands according to adaptability, the adaptability regions being then subdivided according to productivity and finally accessibility. This corresponds roughly to a classification scheme in which the highest category is determined on a climatic, the next on a soil, and the third on a topographic, basis. How Marbut intended to define the lower and, in practice, more important categories is not indicated in his paper.

This outline of a classification scheme shows that Marbut intended it to be a true classification—that is, lands are arranged in categories and classes showing the physical relationships between the different groups. The taxonomic importance of this feature of a classification is stressed by the Land Committee of the National Resources Board [62]. "Tidal marshes, sandy soils, oil fields, and golf courses might be present in an area, but they are not related phenomena and cannot be assigned to classes in a logical system of classes. Tidal marshes, rocky headlands, and sand dunes, however, are related phenomena and can be assigned to classes in a systematic division of shore features. In similar fashion, golf courses, railway yards, and airports are classifiable in terms of the several categories of urban land use."

Land Inventories

Some systems of land classification make little attempt to indicate relationships between classes. Provided they fulfil their purpose they are none the less useful for that, but they would perhaps be more correctly described as land inventories rather than land classifications. Those who employ inventory-type classifications usually define a land type in terms of a summation rather than a synthesis of the separate characteristics. Thus Kellogg and Ableiter [46] define a natural land type as "land having a particular set of defined natural characteristics, principally of soil, climate, relief, stoniness and native vegetation." Veatch [96] says that "the natural land types [in Michigan] consist of various combinations of the soil types, relief features, and topographic forms such as hills, basins, lakes, and swamps." According to Veatch, for instance, a land type could be defined as consisting of soil type A, relief B, topography C and so on, and another as consisting of soil type X, relief Y, topography Z, etc. These definitions or descriptions suffice to give valuable information about land-use potentialities, but they do not indicate how class A B C is related to class X Y Z.

The definition of the type unit for classification is a point at which the physical and social-economic classifications of land tend to clash. In a physical classification the boundaries of a unit land type are naturally those at which the physical factors change, though it is sometimes difficult to determine the actual physical boundary to be marked on a map, or

whether a change in one factor only while all others remain constant justifies the delineation of a land-type boundary. For an economic classification or a classification for taxation purposes a property is often the most appropriate land unit. In some German systems of *Bodenbonitierung*, for example, points are awarded for physical land features, and the points are integrated over an entire property to arrive at the valuation for the property rather than for its constituent land types. Kellogg [44] points out that an important factor determining the best use of an individual farm unit is the manner in which the various soil or land types are associated with one another. "For example, in a hill-valley section frequently good cropland and land suited only to pasture are so mixed that the latter may be used to good advantage in a farm unit having some good cropland, without which a different use, such as forestry or extensive grazing, might be more desirable." The orientation of physical land types in relation to property boundaries may be a determining factor in planning land use.

What is usually described as the physical classification of land is, in fact, more a physical inventory than a classification. There are no universally established physical land classes, as there are universal soil classes or easily identifiable plant families and genera. It is impossible to compound the total physical characteristics into a single entity *land*, because one of the most important characteristics of land—at least for planning—is not physical, but economic.

Haggerty and Meyers [29] list the following characteristics as required to make a physical inventory of land as a basis for land classification.

- Soil:
  - Profile
  - Texture
  - Structure
  - Chemical reaction
  - Content of organic matter and essential plant nutrients
  - Stoniness
  - Internal drainage
- Topography:
  - Elevation
  - Lay-of-the-land
  - Degree of slope
- Native Vegetation:
  - Type
  - Amount or volume
  - Quality
- Flood Relationships:
  - Frequency
  - Intensity
  - Duration
  - Occurrence
  - Physical effects
- Land Condition:
  - Erosion
  - Deposition
  - Depletion
- Water Resources:
  - Kind and extent
  - Dependability
- Climate:
  - Precipitation
  - Temperature
  - Frost-free period
  - Climatic hazards

Haggerty and Myers recognized, however, the desirability of not merely describing land types, but of grouping them into classes according to the nature of the adjustment required to fit the land-use plan.

In Germany the main items of a land inventory were soil, topography, water resources, climate and economic conditions. The soil was further inventoried according to genetic type, texture, depth, stoniness, cultural condition and reaction. Much more attention was paid in Germany than is paid in the United States to economic items—market facilities, transport and communications, labour supply, system of land tenure, size and shape of farms, etc. An additional item which was to have been systematically inventoried was the content of available potash, phosphate and lime. A special service—*Bodenuntersuchung-Sonderaktion*—was at the beginning of the war engaged in making these determinations. The aim was to sample and analyse every quarter hectare of agricultural land. Between 1936 and 1942 over 4,450,000 determinations of lime status, 3,000,000 of phosphate status and 625,000 of potash status were made on soils of the German Reich [30].

The U.S. Soil Survey

Nearly all the factors listed by Haggerty and Myers [29] are now inventoried in the standard U.S. soil survey which has, in fact, developed into a combination of a soil survey proper with a land-type inventory. To an ever-increasing extent the U.S. Soil Survey is becoming a land survey, and it is possible that if ever a universal system of land classification is developed it will emerge out of the present work of the U.S. Soil Survey. Milne [56] quotes the Chief of the Soil Survey as stating that its results " form the factual basis in the development of sound programmes of land use." Soil surveyors are constantly reminded that it is the land rather than the soil that is to be investigated, classified, inventoried and interpreted, primarily though not exclusively by the soil profile.

As the survey becomes more practical—more of a land and less of a soil survey—there is, for example, a tendency to give more weight to texture in the definition of soil type. The American soil type is a combination of a *series* and a *class*, the series defining the general morphological characteristics of the soils comprising it, and the class the texture of each soil at the surface. Thus the *series* name Hagerstown describes an indefinite number of soils identical in all important characteristics except texture (*class*). Hagerstown loam, Hagerstown sandy loam, etc. are distinct but related soil *types* differing principally in texture. But it has been found that whatever may be the scientific justification of classing a clay and a sand (say) in the same series, in actual agricultural use there is likely to be a more pronounced difference between the behaviour of a clay and a sand of the same series than between two clays or two sands of different series. In other words, texture, which cannot be accorded a position of very great importance in a genetic or morphological system of soil classification, becomes a dominant factor in a " use " classification.

The trend of soil classification in the United States from a morphological to a use basis is reflected in the growing recognition of *monotype series*—i.e., the inclusion of texture in the definition of a soil series, or the identifi-

cation of soil series with soil type. Soils formerly regarded as belonging to the same series by reason of common genetic and morphological characteristics are now classed as different series by reason of their different use capabilities as indicated by their respective textures. At most three, and more commonly one or two, textural classes are now included in one series.

While the soil type is thus tending to disappear as a separate taxonomic category—or to be merged into the series—other categories are appearing, some lower than the series (e.g., *phases*), others higher (e.g., *associations*). The phases of a soil series or type are distinguished by some use characteristic such as stoniness, degree of erosion or slope—slope being judged not by its steepness, but by its effect on land utilization. An association is a group of soils, either similar or dissimilar, geographically associated in a regular pattern over a landscape feature. It is similar to the *catena* described for tropical landscapes by Milne [55].

To " charge the soil type with the maximum load of land-use meaning " [60] is the prevailing trend in soil survey in America at the present time, but Krusekopf [48] considers that most soil surveyors, while duly inventorying important land characteristics such as slope, stoniness, erosion, etc., have failed in their task of interpreting the primary morphological features of the soil in terms of land use. The soil surveyor, in fact, has the difficult task of maintaining an objective, scientific approach to soil classification and at the same time making the results of his work useful and intelligible to those who know nothing of the restraints imposed by pedological discipline. Milne [56] describes the soil surveyor's approach to land classification in the following words :—

> The soil surveyor regards himself as a student of the land who, being a soil scientist first, distinguishes his land types primarily by soil profile. He knows that considerations regarding the use of land may be in error if they leave the soil profile uninvestigated, and his own first duty, as a key man in this sense in the rationalization of rural production, is the expert recognition of the varieties of soil profile that exist in his piece of country and their reduction to a manageable number of series and types. In this stage of his work he is a pure pedologist, adding to soil knowledge or establishing the validity of existing concepts on new ground ; he may classify and describe soil types in whatever terms the technicalities of the subject require.
>
> As he goes about in the field plotting soil-type occurrences, he must, however, bear in mind that he will have the further duty of making clear, for all who follow him on land questions, what the significance of his data is. He must endeavour to work to the condition that after he has finished, no further visiting of the ground shall be necessary for the ascertainment of omitted or obscured facts regarding land type. He must, therefore, pay attention to a good deal besides soil profile. His land types are finally to be so defined (having regard to the limitations of the scale on which he is working) that the most desirable use of them can be inferred by other specialists (such as agronomists, foresters, or the administrators whom these advise) simply by superimposing their own particular technical knowledge on the pattern he has provided. Qualities such as topographic character and slope (expressively summarized in the American language as "lay of the land") ; stoniness ; other kinds of irregularity of surface such as animal burrows (or, in Africa, termite mounds) ; depth available for root-development ; nature of plant cover, if uncultivated ; susceptibility to accelerated erosion ; degree of erosion already suffered ; exposure to wind or liability to river overflow—all these are

relevant, and all must be incorporated along with soil profile and texture of top soil into the "natural land-type units" which are to form the items in the completed inventory.

The natural land types having thus been determined on the basis of their physical and, to some extent, their biological characteristics—the latter from the viewpoint of describing each land type as a distinctive "habitat"—their description can be carried further (in inhabited country) by recording whatever can be ascertained of man's experience in using them. There is clearly a wide field of relevant enquiry here: crop-plant behaviour, crop yields and qualities; thriftiness of stock, stock-carrying capacity, rates of natural increase; population densities, human health, and attainable standards of life earned on the land . . . .

It will be seen that the "natural land type" signifies a great deal more than the "soil type" does. Not only must the soil surveyor working to those objectives be a good judge of a pit section or auger boring, and a painstaking plotter of boundaries, he also needs to have a good eye for country, and a quick appreciation of a situation in physical geology. He must be a receptive observer of many kinds of natural phenomena, especially those of vegetation and plant succession. His acquaintance with crops and cultural practices, and his judgment in sifting the results of enquiry, must be enough to enable him to estimate what have been, and what will be, the probable interactions between man and the soil in both directions; for in long-occupied territory the "natural land type" cannot easily be disentangled from the existing pattern of "social land units" and customary usage; the top soil has become the "M-horizon," and to understand it requires more than mere expertness in soil morphology.

The results of soil survey, then, whilst being based on sound pedology, must be so reported as to convey a maximum of information about potentialities in land use.

The importance attached by the Soil Survey to the collection and presentation of miscellaneous information relating to land use is indicated by the following quotation from Kellogg [44], describing the nature of the soil-survey report.

The soil-survey report which accompanies the soil map describes the area surveyed, the characteristics and capabilities for use of the soil types and phases shown on the map, and the principal factors responsible for soil development. It is an integral part of the complete publication and not simply an adjunct to the soil map. Except as a base map, the soil map without the report is of little use to persons unfamiliar with the specific nomenclature employed. First of all, the report contains a complete description of the soil types shown on the map and their relationship to one another. As the objective of the work is to provide information directly relating to the agricultural use of the land, those characteristics of importance in the use of the soil for growth of plants are stressed.

Much of this information is obtained by observation during the course of the survey, but by no means exclusively so. Climatic, chemical, economic, agronomic, and all other data bearing on the nature and capabilities of the soil from other sources are used to the extent that such information is available and can be interpreted in relationship to the soil types occurring in the area. To the extent that the location of the soil areas in respect to markets and similar factors have an important bearing on the use of the soils, these relationships are identified and discussed.

More detailed instructions given by Kellogg, and reproduced in the Appendix (p. 86), for the preparation and arrangement of soil-survey reports illustrate the very wide scope of the survey which is, in fact, a land survey based on a straightforward soil classification—a social-economic inventory superimposed on a physical classification. It is rather more than a land classification, but it can provide much of the information required in land-use planning. In recently issued soil-survey reports a section has been devoted specifically to land classification, the classification adopted being

usually the arranging of the soil types in the order of their " productivity grades " (p. 69).

Land Types and Soil Types

Whether the soil type—in the American sense—can serve as a unit for land classification obviously depends on the objective of the latter. In so far as that objective is to adapt crop production to the quality of the soil, soil types and physical land types will tend to be coextensive. Moon [60] maintained that for the Tennessee-Valley soil-survey project, the objective of which was " to provide data of value to problems of land use and management, particularly for the production of useful plants," the soil type provided a natural unit for land classification. The classification required was one of soil productivity, and the class-distinguishing criteria were therefore all the soil characteristics, both internal and external, significant for productivity. Among the internal characteristics Moon includes physical, chemical and biological properties, and among the external characteristics moisture conditions, topography, conditions of erosion, stoniness, and depth to solid rock.

But whereas in the determination of soil types the relative significance of the different characteristics is constant, in the determination of land types the significance of each characteristic depends on the purpose of the classification. " It is not only necessary that all these soil characteristics—internal and external—become a part of the basis of classification, but that each of them be assigned a place appropriate to its relative significance to the natural physical adaptation and use capabilities of the soil—if the soil type is to fully express itself as a factor in land classification for plant-production uses." A factor such as depth of soil or stoniness may become " critical " at a certain intensity, and must then be given special emphasis if the soil type is to express its full significance to land classification. The soil type's fitness, states Moon, to serve as a unit for land classification is determined by the extent to which the variability in relative significance of the different soil characteristics is adapted to the objective of the classification.

By taking external as well as internal characteristics into consideration —i.e., by classifying land rather than soil, but on the basis of the soil type—the number of classes is very greatly increased, as also is the cost of the survey. The utility of the survey is increased proportionately. Moon lists ten maps which can be plotted from the soil-survey map as prepared in the Tennessee Valley :—(1) a general productivity map, (2) a potential land-use map, (3) a lay-of-the-land map, (4) a general erosion map, either of conditions resulting from past erosion or of natural susceptibility to future erosion, (5) a map of stoniness, (6) a natural zoning map, (7) a relative evaluation map, (8) a detailed natural-drainage map, (9) a crop-adaptation map, (10) a land-management map.

Veatch [95] says that in most of the American soil-survey reports the soil types described are in reality land types, but appear to be neither because of the attempts in the text of the report to describe them as soil

instead of land types. But while a soil type may be identifiable with a land type it does not follow that the same soil type in two different localities will represent the same land type. This lack of identity is due to the intrusion of external features and the varying emphasis placed on them in the determination of land types.

Land types and genetic soil types

Stremme [85] goes further than American workers in identifying land and soil types, and maintains that the genetic soil type is a scientific unit corresponding to natural land-use types. In Germany, where it may be assumed that land use has in the course of time largely adjusted itself to land type, the dry-steppe soils are used predominantly for wheat, roots, spring barley and lucerne, oats are grown largely on Bunter Sandstones, Marls and Clays, potatoes on heath soils, meadows on mountain soils, rye on *Eschböden* (artificial soils made from podzolized forest or heath soils by treating them with turf or stable manure, and forming a distinct type in north-west Germany), winter barley and clover on grey forest soils. Although oats, rye and potatoes occur on all soil types, other crops have become almost "selective" enough to be used as indicator plants of groups of related soil types.

Studies of the yields obtained on the genetic types distinguished by Stremme and his collaborators on purely morphological grounds showed that four classes of soils could be distinguished according to average gross yields of the commoner crops :—

1. Most steppe-like soils are exceptionally good for grains, grasses and cultivated crops.
2. The moist and better brown forest soils and the better moor-like (*anmoorig*) soils are good for grains and cultivated crops and very good for grasses.
3. The poorer, moderately podzolized, brown forest soils are medium-quality grain (except wheat) soils, indifferent to good potato and fodder-beet soils, sometimes good grassland soils.
4. The rust-coloured (podzolized) forest soils and the poorer moor-like and moor soils are very bad for grains, and bad for potatoes, roots and grasses.

Sellke (cited by Stremme) independently distinguished four soil-type groups, slightly different from the above, according to yield data :— (1) steppe-like soils ; (2) brown forest soils, rendzinas ; (3) cultivated podzolized and heath soils ; (4) mountain soils.

Several attempts have been made in Germany to evaluate the genetic soil types according to their productivity. The genetic type being a much wider conception than the American soil type, a correspondingly wide range of productivity rating is to be expected. Stremme gives tables by Sellke, Ostendorff, Taschenmacher and Przeperski showing that there are significant differences between the ranges of variation of productivity, expressed on a percentage scale, of different genetic types. Thus, according to Ostendorff,

the rating of steppe-like soils in Danzig and East Pomerania varied between 100 and 70, of brown forest soils between 75 and 40, of weakly, moderately and strongly podzolized soils between 55 and 20, 44 and 20, and 30 and 0, respectively, and of mountain soils between 30 and 0.

These figures, giving the highest and lowest productivity of each type, were derived from a study of over 1,100 soils. Although the range of variation is too wide for them to be used for deducing the productivity of an unknown soil from its morphology, they indicate nevertheless that there is an inherent relationship between the genetic type and the agricultural value of a soil. Stremme could discover no such relationship between soil class and productivity when soils were classified into geological, petrological or textural groups.

Sellke states that the importance of the genetic soil type as compared with the soil variety (*Bodenart*—textural distinction) in the evaluation of productivity increases with the age of the soil. In very young soils texture may be, but in mature soils the entire morphology of the profile becomes, the determining factor in productivity. In mountain districts greater variation is caused in forest growth by differences in slope and exposure than by differences in the geological substrate.

The Russian view on the relation between land types and genetic soil types is given in general terms by Gerasimov *et al.* [22] who appear to identify genetic soil types with geographical landscape types—i.e., the soil type is a " concrete " expression of the totality of the landscape. This view has more theoretical significance in the definition of natural landscape types than practical significance in land-use planning. Magnitsky [51] has briefly, and not very clearly, indicated how the first broad grouping of soils on a genetic basis can be subdivided for land-use planning purposes. The soil macro-complexes are classified not only on their natural characteristics, but also taking into consideration past and present land use (agricultural history), and particularly its effect on soil productivity. The soil types (? land types) are distinguished according to productivity (yield data) and the measures required to raise them to the level of fertility demanded in the land-use plan the nature of which is determined, presumably, by both the qualities of the land and political considerations.

The soil macro-complexes are subdivided into " meso-complexes " the precise nature of which is not explained. The subdivision is made according to the intensity of agriculture practised (whether present or planned is not clear), the nature of the agro-technique required to ensure high yields, and the agricultural system to be adopted.

Magnitsky's paper is the only reference we have found to the procedure of land classification in the U.S.S.R. We have found no description of the application of this or other procedure in practice. It would appear from Magnitsky's paper that the soil macro-complex (association of genetic types) determines the broad features of the plan—whether the region is to be used mainly for grain, fruit, livestock farming, etc.—the plan is then

worked out in greater detail, and the soil macro-complexes then subdivided into meso-complexes to fit the requirements of the plan.

Land-use Classes

Kellogg [43, 44] defines a land classification according to use capabilities as "one in which bodies of land are classified (on the basis of physical, or both physical and economic considerations) according to their capabilities for man's use, with sufficient detail of categorical definition and cartographic expression to indicate those differences significant to man." In such a classification the "natural" aspects are subordinated to the practical. The emphasis is on the use rather than on the land. Kellogg puts all land in use into eight use groups (1) cropping, (2) grazing, (3) forestry, (4) recreation, (5) mining, (6) urban development, (7) wild-life preservation, and (8) protection (flood control, anti-erosion, etc.). (7) and (8) are usually combined with some of the other six, and combinations such as forestry-grazing, grazing-cropping, forestry-protection are common.

The use class of any land unit is determined as much by economic and social factors as by inherent environmental factors. These factors, by their nature transitory and variable, must be considered separately from the permanent, inherent factors. "Any change in utilization alters the position of the land in the classification of the social land units; whereas the more fundamental classification of the natural land types is essentially permanent. For example, should the boundaries of some proposed grazing or forestry district include present cropping land, a reclassification would need to be made giving this land its rating in the new use group in place of its rating in the cropping use group. Where the fundamental physical data are kept clearly separated from the economic or social, as the logic of the method demands, such changes are easily made without additional field work" [46].

Tyler [91] distinguishes between the physical classification of *land types* and the economic classification of *land areas*. A complication is introduced by the fact that the boundaries of the natural land types and of the economic land areas do not necessarily coincide.

Kellogg [43, 44] offers the following outline of a scheme of land classification.

1. Objective: Classification and extension of data regarding land; planning of land utilization.

(Detailed expression also furnishes basic physical classification for objective under 2.)

Climate Soil Relief Stoniness (Vegetation)	Natural land type. To be classified into categories according to relative physical capability in possible types of utilization.

2. Objective : Rural zoning ; tax assessment.

Natural land types (detailed expression)
Relationship to social groups
(a) Economic
(b) Social

} Social land unit.
To be classified :
(1) Into use groups :
(a) Cropping
(b) Grazing
(c) Forestry
(d) Recreational
(e) Mining
(f) Wildlife preservation
(g) Protection
(h) Urban
or definite combinations :
(i) Crop—grazing
(j) Crop—urban
(2) As to capabilities within the use group.

If the classification is to be used for land-planning purposes there must obviously be some correspondence between the "natural" and "use" classifications, that is, the criteria used to distinguish natural land classes must be related to those used to distinguish use classes—e.g., soil-fertility characteristics.

Kellogg outlines the procedure (particularly for soil surveyors) to be adopted in actually classifying and mapping land-use capabilities :—

(1) The first essential includes the accurate mapping, in detail, of the physical features of the land. The basic data are those regarding the soils that are mapped in accordance with the modern system of soil classification. Cognizance is also taken of relief, stoniness, native vegetation, and any other physical features of local importance in land use. These may be regarded as the external characteristics of the soil type. Combinations of these features give the natural land types which cannot be assigned definite ratings of productivity in the various use groups. In order that these natural land types may be interpreted in accurate terms, it is essential that the maps show sufficient detail, both as to definition of the categories and as to cartographic expression. *Individual land types of a size sufficient to influence significantly the capabilities of separate units of operation need to be separated.*

(2) Coincident with, or subsequent to, the mappings of the natural land types, the inherent productivity, including "responsiveness" to cultural practices, of these types must be determined in each of the possible use groups. The ratings should not reflect transitory economic considerations but should be based on the essentially permanent physical factors of productivity. These ratings must represent the generalization of all information available, including that obtainable inductively considering the nature of the land, and that acquired deductively from analyses of practical experience and experimentation. Conveniently these ratings of each land type may be expressed in terms of percentage of a standard, taken as the best land, from a physical point of view, in each of the use groups.

(3) The next step in the procedure is the determination of the use group for each tract of land. Especially in areas that have been settled for many years this determi-

nation will be made largely on the basis of the physical qualities of the natural land types. Other factors, such as accessibility to markets and the size of contiguous areas of similar land types will also be important, especially in a new or rapidly changing section. For example, an area having a natural land type ever so well-suited to cropping cannot be placed in the cropping use group, should the area be too small for a unit of operation or isolated from other land suitable for cropping. This and similar considerations make it necessary sometimes to place land naturally suited to crops in the forestry or grazing use groups, and subsequently the land must be rated in that use group.

(4) Finally, each social unit of land is rated in the use group (or use groups) in which it belongs. The ratings of the natural land types within the use groups are basic, but these need adjustment according to economic or geographic considerations which may influence production on these social units. Such considerations include accessibility to markets, nature of the existing vegetation on forest and grasslands, and similar factors. By an analysis of production on the standard or ideal land, and the marketing costs at various distances on the different classes of roads, a schedule may be prepared showing the percentage reduction in the basic rating of the land for various locations. Similar schedules may need to be calculated in respect to the other factors.

As a final result, each piece of land can be given a rating in terms of the percentage of the standard for the area or region. If the classification is then used for purposes of tax assessment, the proper local officials need to place an appraisal value on the standard land, and every piece of land in the area takes its appraisal value strictly in accordance with its productive capacity. Ratings given by such a land classification need to have added to them an appraisal of buildings and improvements for loan purposes or for tax assessment where such improvements are taxed. It must be emphasized again that the physical data should be kept separated from the economic, including the basic ratings of the natural land types ; as a result of any changes in economic conditions, the necessary adjustments of the ultimate land classification can be made easily without additional field work.

The productivity ratings referred to above are described on p. 69 and following.

Bausman [7] lists five different measures of land classes commonly used in land-classification studies. None of them is a complete measure, but each serves as a check on the others. Soil types are the most widely used and generally the most effective measures of land classes. Their chief weakness is that they do not reflect the effect of location on land use ; not only the effect of distance from market or town, but also the effect of location relative to other land types. A parcel of poor land would have a higher use capability on an otherwise good farm than it would have on a poor farm.

Crop yields afford a good measure of land classes if the land is used for cropping. They are of little use on pasture or forest land. Bausman points out that on many poor farms the proportion of cropped land is low, but it receives all the manure produced and consequently gives higher yields than would be expected from its " inherent " properties.

Size and condition of buildings are a fairly good measure of land classes. Good land usually requires larger buildings for storage and shelter than does poor land. As often as not the *condition* of the buildings is more a reflexion of the personal habits of the occupier than of the quality of the land. On farms near towns or owned by urban dwellers or supported by urban capital, the size and condition of the buildings bear little relation to the class of land.

Net farm income may be used as a measure of land classes, but the data are usually costly to obtain and become unreliable when any appreciable proportion of the income is derived from enterprises not closely associated with land quality—e.g., poultry, flowers, market gardening.

Bausman favours intensity of land use as the most reliable single measure of land classes, on the grounds that the occupiers will, over a period of years, discover by trial and error the optimal land use under prevailing conditions. He recognizes, however, that there is usually a lag in land-use adjustments that needs to be taken into account. The relative validities of the different measures vary widely from situation to situation, and there are no general rules for assessing them.

Agricultural Regions

As Marbut (p. 13) pointed out, the climatic factor in land-use classification is related to crop adaptability. So far as adaptability is concerned, in most areas coming under a single plan the climatic factor can be regarded as constant, except in mountainous or topographically dissected regions. Local climatic variations assume increasing significance as the intensity of land utilization increases, but since intensive farming cannot be carried on for long unless land use is adapted to the environment most intensively farmed countries have not felt the need for land-use planning. Use is already reasonably well adapted to the land. Climate has, indeed, found more use as a basis for demarcating broad agricultural regions than in detailed land classification. It is the dominant factor determining the suitability or otherwise of a region for a particular crop.

Stamp [82] states that in Europe temperature—particularly in the growing season—is the most significant climatic element governing the adaptability of a region to the culture of one or other crop. Passing from south to north, summer temperatures decline, and successive limits are reached for the ripening of rice, maize, wheat, oats and barley. Thus a physical or geographical limit is set to types of agriculture based on these different food grains.

Winter cold is another factor influencing types of crop culture. The intense winter cold of south-east Europe renders autumn sowing of grain impossible, and spring wheat takes the place of winter wheat. The spring-wheat region of Europe is practically coextensive with the black-earth or chernozem zone, characterized by a semi-arid, highly continental, steppe climate. Similarly, the northern limits for the olive, orange and lemon are determined by the incidence of winter frosts, and the northern boundary of the zones of culture of these fruits coincides with that of the Mediterranean climatic region.

Rainfall in Europe is usually adequate, and sometimes excessive, for agriculture. Where it is insufficient—in the south and south-east—irrigation is practised. Where it is excessive pastoral farming or no agriculture (forest), and where it is adequate arable farming, predominates.

In the delimitation of agricultural regions the soil factor tends to follow the climatic factor, since the genetic soil type is primarily a climatic phenomenon. It does not, however, follow that the boundary between two recognized soil or climate zones will also be a boundary between two agricultural or land-use regions. It is soil poverty, however, which brings the rye-growing region into parts of Europe that climatically would have been regarded as a wheat-growing region. The limit of wheat- or maize-ripening is not necessarily related to the distribution of any natural plant association and its corresponding soil type. Certain close correspondences do occur—e.g., between the spring-wheat and chernozem zones, and between the olive and Mediterranean-climate (terra-rossa) regions—but the boundaries of both agricultural regions and of soil or climatic zones are naturally very ill-defined. The transition belts from one agricultural or soil zone to another are often very wide. It is convenient, therefore, to make the agricultural and climatic (or soil-type) boundaries coincide as far as possible on a map so as to emphasize the indubitable significance of climate in determining crop adaptation. Thus, several of the boundaries in Jonasson's map of the agricultural regions of Europe [42] correspond closely to the boundaries of the soil zones in Sibirtsev's soil map which was drawn partly from climatic data as well as from direct observations of the soil, but was later considerably modified by Stremme [87].

While climate exercises the most obvious control over the distribution of broad agricultural types it is by no means always the determining factor. Economic, political and social controls may be equally or more potent, particularly in populous regions.

> Almost as obvious as the broad resemblance between maps of climate and agriculture, are the marked discrepancies. Dry interior Asia-Africa has not the same agricultural system as dry interior Americas and Australia. The types covering wide acreage in the humid middle latitudes of the northern hemisphere are not extensively spread in the southern. Most conspicuous of all, the agriculture of east and south Asia, notably China and India, does not parallel counterpart climates in the other continents. Differences spreading over such broad areas cannot be attributed to variations in soil or slope, which are miniscule in comparison. They do correspond to what may be loosely defined as Occidental versus Oriental society and progressive versus backward culture. Some of them correspond also to marked contrasts in density of population [98].

The actual boundaries of agricultural regions, so far as they can be defined at all, are determined not solely by physical conditions (temperature, moisture, topography, soil), but are rather the result of the pressure of population against these conditions, the pressure varying with the stage of civilization and technical achievement attained by the people [5].

The effects of industrial development, when highly concentrated as in western Europe, may outweigh those of climatic or physical controls. Most of industrialized Europe—Great Britain, Northern France, Belgium, Holland, Denmark, Germany, and parts of Czechoslovakia and Poland—are included in what Jonasson [42] calls the Dairying, Hay and Root-crop Region. The agriculture of this region is characterized by intensive, highly diversified mixed farming, with livestock predominating. There is nothing

in the climate or soils particularly favourable to this kind of farming, which has evolved in response to the demands of dense, urban populations. Ellsworth Huntingdon (cited by [82]) and Jonasson consider that the physical environment is peculiarly favourable for high production, though it may be noted that Marbut [52] considered that humid forest soils (pedalfers) like those of western Europe were in general much less adapted by nature for sustained food production than the semi-arid grassland soils (pedocals). Huntingdon supports his statement by average yield data for the most common western-European crops. If the average yield for Europe is 100, that of Belgium is 179, of Holland 170, of Denmark 168, of Switzerland 155, of England and Wales 146, of Germany 127, and of France 105. It may be noted, however, that this order of productivity has less to do with the quality of the soil than with the consumption of fertilizers per unit of arable land. The order of fertilizer consumption per arable acre before the war was Holland, Belgium, Germany, Denmark, Great Britain, France [17]. If the manurial value of imported animal foodstuffs were taken into consideration, figures for fertilizer consumption in Denmark and Britain would be considerably raised, and the order of fertilizer consumption would approximate to the order of productivity. There can be little doubt that both the type of utilization and the high level of productivity of western Europe are less closely related to physical than to social and economic controls. Intensive mixed farming has developed because it is the only known system that could support a dense industrialized population. One of the most valuable root crops in the European root-crop region is sugar beet—an example of the effective influence of a political control, since beet sugar can nowhere compete freely with imported cane sugar.

Jonasson [42] claimed to be able to distinguish seven zones of production around large urban centres, and reflecting the influence on land utilization of distance from market. These zones do not usually exist in their entirety in actual fact, owing to the intrusion of other than commercial factors in the determination of land utilization, but they are apparent in part around cities like Moscow, Indianapolis and Buenos Aires. Stamp [82] states that they can also be traced in Britain. The zones, extending, ideally, concentrically from the urban centre are :—

I. Horticulture
- Zone 1. Greenhouses and floriculture.
- Zone 2. Market gardening—fruit and vegetables.

II. Intensive agriculture with intensive dairying
- Zone 3. Dairy products, fat cattle and sheep, forage crops.
- Zone 4. General farming—grain, hay, livestock.

III. Extensive agriculture
- Zone 5. Bread cereals.

IV. Extensive pasture
- Zone 6. Rearing of cattle, horses and sheep.

V. Forest culture
- Zone 7. Peripheral areas, forests.

Baker [5] states that " not only are the physical conditions the principal factors in determining the utilization of the land in a region and the crops grown ; but also they become more important as population increases, the knowledge and practice of agriculture advance, transportation facilities are improved, and the supply of capital and labor is increased and better distributed ; in brief, as agriculture and forestry become more highly organized and commercialized."

This statement seems at first sight at variance with the view previously expressed that a highly developed industrialism masks the effects of physical conditions on land use, but Baker was referring to the United States which still are more agricultural than industrial. They have only quite recently, with the development of transport on a continental scale, emerged from the stage of self-sufficient farming to that of commercial farming, an early phase of which is the concentration of crops in the regions where they can be most economically grown. Formerly, for example, fibre flax was grown for home consumption on almost every farm, but now it is imported, and flax is grown commercially almost wholly for oil, and is restricted to the sub-humid areas of the North-west where the physical conditions are peculiarly favourable. Again, with the commercial development of cotton, competition has restricted the crop to the area where it can be most economically grown. There is a general tendency for the farming community to concentrate in the more fertile areas and to abandon the less fertile, owing to the greater capacity of the former class profitably to utilize large amounts of capital and labour. Thus between 1910 and 1920 the most fertile farm lands of Illinois increased in value by 79 per cent, while the least fertile lands increased by only 41 per cent.

The general tendency at the present stage of American civilization is for economic forces to operate in the same direction as physical conditions in the determination of land use. The increasing use of farm machinery, also, is emphasizing the significance of topography ; accessibility for agriculture and adaptability to mechanization, and inaccessibility and non-adaptability usually go together.

Three stages may be distinguished in the normal evolution of " agricultural regions ". At the beginning of settlement there is a pioneer stage in which the land is made to produce anything which will allow the settler to exist and hold his own against a still untamed Nature. This stage tends to be exploitative, since the system of land use is dominated by the individual's struggle for existence. Both physical and economic controls operate, but not very specifically. Crops are grown because the cultivator needs them for his day-to-day existence rather than because the land is specially suited to them. It was during the pioneer stage that much of the soil exhaustion and erosion of the modern world originated.

A subsequent stage may be distinguished as a social and economic organism emerges, and a sense of permanence in the occupation of land, extending beyond the span of a man's life, becomes apparent. Land use becomes more closely adjusted to local variations in the environment, more

conservative and less exhaustive. It is at some time during this stage that the relative influence of physical controls is maximal—and that the need for land-use planning is most likely to be felt. Parts of the United States at the present time afford good illustrations of the transition from exhaustive to conservative land use, and of the application of land-use planning to meet the problems raised thereby.

At a still later stage the influence of economic and technical controls increases relatively to that of physical controls. Men have learnt not only to adapt their crops to the environment, but also to modify the environment to suit particular systems of agriculture—for example, by intensive manuring as in western Europe, or by terracing and other soil-conservation measures as in Japan and Java. Further desirable adjustments in land use that could be assisted by planning are mainly to economic and technical developments.

The estimation of population capacity

Hollstein [37] has attempted a quantitative distinction of agricultural regions according to the maximum populations the regions are capable of supporting off their own produce when the land is utilized at an equal, but arbitrary, level of intensity. He maintains that climate is the principal natural factor determining the possibilities of land use. This becomes more evident, the broader and more general the picture of land use. Nevertheless, single factors such as distribution of rainfall throughout the year or in hot or cold seasons, relation of temperature to rainfall, distribution and quality of sunlight, etc. that cannot be incorporated into a climatic classification are often so important for land-use determination that none of the accepted systems of climatic classification is adaptable as a basis for land evaluation. In other words, no practical relationship has been found between the separate climatic factors (rain, temperature, sun, wind, etc.) that will express the crop-producing potentialities of the land.

Hollstein measures productivity by the capacity of a region to produce human foodstuffs. Since food production varies greatly in quantity according to the type of agriculture (e.g., mixed or specialized farming) grain-producing capacity is taken as standard. Grains are the most important food crops, and their short growing periods and other characteristics make them particularly suitable as measuring rods of productivity. Grains are cultivated everywhere, and all the common grains have approximately the same calorie value per unit weight (3,300 per kg.), consequently the grain yield is also a measure of the energy-producing capacity of the land. If land is used entirely for the production of animal food the calorie value of the animal products ultimately obtained for human consumption is about one-fifth of what would be obtained by growing vegetable food for direct human use. Under intensive horticulture the calorie value can increase from four to eight times that under grain cultivation.

As basis for his calculations Hollstein uses the actual yields obtained in the cultivated parts of the regions concerned, and from these data he calculates the calorie value per unit area of land.

By dividing the calorie value by the arbitrary figure 2,500 the number of "human feeding days" per unit area is obtained. Multiplying this by the fraction of the total land area that is cultivable, a "quality number" (*Wertzahl*) for the region is obtained. It will be seen that the operative values are the average grain yield and the proportion of cultivable land; the interpolation of calorie values and human feeding days involves merely multiplication and division by two constants which do not affect the relative significance of the quality numbers obtained. E.g., in the south-China plains a yield of 35 dz./ha. of grain provides the calorie requirements of 1,265 men per square kilometre. 80 per cent of the total area is cultivable, thus the population capacity is reckoned as 1,012 per square kilometre. The actual population density is 900—85 per cent of the calculated population capacity, and 71 per cent if the whole area and not only four-fifths of it had been utilizable. The "utilization factor" (*Ausnutzungsfaktor*) is 0.71. In one part of Shantung population density (821 per sq. km.) is greater than population capacity (723) calculated on a basis of four-fifths of the land being optimally used for food production, but taking the province as a whole the ultilization factor works out at 0.55.

Goodson [24] points out that one result of this method of calculating potential productivity is to discriminate in favour of regions where maize is grown, since maize has a much heavier yield capacity than wheat or barley. (It also requires about double the labour input of the smaller grains, a factor which does not enter into Hollstein's calculations.) Consequently, south-eastern Europe gets a higher assessment than actually much more productive countries in western Europe. And by assuming an intensity of use at present unattainable in the Amazon and Congo basins these regions get the highest ratings of any in the world.

Goodson also draws attention to the difference between the estimates of Hollstein (373,300,000) and of Griffith Taylor (20,000,000) of the numbers of population supportable by Australia.

Population and land quality. Attempts have occasionally been made to relate the population of rural communities, free from industrial or urban influences, to the inherent properties of the land. Mohr [59] established quite a close relationship between population density and soil quality in some islands of the Netherlands Indies. The nature of the volcanic deposits which cover much of Java and the age of the soils derived therefrom had a predominant influence on population density, sometimes even greater than that of industrialization or urbanization. Volcanic soils in the early stages of formation are usually the most fertile, and Mohr showed how the depositions from the latest eruption (1931) of Mt. Merapi mainly to the south and south-west of the volcano were reflected in the higher populations in these directions. In general, districts with the most juvenile volcanic soils have the densest populations. Heavy rainfall, by leaching the soils, has a contrary effect, hence the younger the soil and the lower the rainfall (provided it is sufficient) the denser the population. Somewhat similar relationships between soil and population were observed in other islands

of the archipelago, but were not so clear as in Java, owing to the less extensive distribution of young volcanic soils. Where these did occur, however, the populations tended to be densest.

Smits [77] considered that topography had a still more potent influence than the origin of the soil on population density, the densest populations being found in narrow valleys and on gentle slopes (of volcanoes) where primitive and small irrigation works could be installed. The banks of large rivers in the coastal plains (of the Netherlands Indies) where the land was subject to regularly occurring floods in the rainy season were also marked by high population density.

The Use of Natural Vegetation as an Indicator of Land Quality

Several suggestions have been made to use plant indicators to assess the suitability of land for producing particular crops, but the method does not seem to be much used, partly because the indications given in one region cannot always be relied on to be valid elsewhere. According to Shantz [76] correlations between the natural vegetation and the crop-producing capabilities of land in any area can be satisfactorily determined only after careful study of the different vegetation types in relation to their physical environments, and such correlations will need to be modified before they can be applied in another region where the physical conditions are different. With this proviso, Shantz, writing in 1911, considered that natural vegetation afforded the best basis then available for classifying land. At that time soils were distinguished on a textural or geological, not on a genetic, basis.

More recently, Hollstein [37] has expressed the opinion that the vegetation is a better indicator of crop-producing capacity than is the genetic soil type. He points to the difference in capabilities between the Eurasian steppes and the South American pampas, both of which, he says, have soils of the chernozem type, yet the former have a hard winter and short growing season that greatly limit the choice of crops, while the latter enjoy mild winters, can produce a great variety of crops, and sometimes two harvests in a season. It is, however, possible that a detailed comparison of South American and Eurasian black earths would have revealed as significant differences between them as exist between their respective climates and vegetations. There is in general a close correspondence between natural vegetation and genetic soil type. The advantage of using the vegetation rather than the soil as an indicator is that small, but significant, differences are more immediately obvious in the vegetation. Specific plant indicators—e.g., *Albizzia* spp. as indicators of suitable soils for tea [41]—in particular are easy to identify and to interpret, again with the proviso that the indications may be unreliable outside the area where they have been established by direct observation. Analogous soil indications—e.g., high hydrolytic acidity for tea soils—are usually insufficient by themselves. The soil, on the other hand, is more durable than the vegetation,

and often retains many of its original characteristics after all trace of the natural vegetation has been destroyed.

One of the chief characteristics required of a reliable plant indicator is that it should be exacting in its habitat requirements [73]. Plants with a wide range of growth conditions are obviously unspecific as regards habitat. Clements [13] maintains that the dominant species which constitute a climax are the best indicators " since they bear the unmistakable impress of the climate in the corresponding life-form, viz. tree, shrub, and grass." Climax indicators, according to Clements, express the type and degree of climatic control and the problems confronting man in maintaining the climax or modifying or permanently replacing it by cultural forms of land utilization. The whole plant community, since it integrates the response to the habitat of several dominant species, is a better indicator than are individual species.

Shantz [76] also deprecated the tendency to base judgments about land quality on the presence of individual indicator species ; the composition of the plant cover as a whole forms a much more reliable basis. " In considering the correlation of natural vegetation with crop production many of the difficulties experienced in correlating vegetation with the physical environment are eliminated. Broadly speaking, the native plants obey the same physiological rules as do cultivated plants having the same general requirements with respect to moisture, heat, and light. Hence, it should be comparatively easy to infer from the differences in the native vegetation produced by differences in the physical environment what would be the effect of similar differences upon cultivated plants."

Working in Eastern Colorado he found good correlation between land capability and vegetation. Land carrying a pure short-grass cover was found to be supplied with water in the surface foot or two of soil only, and usually only for a short period during spring and early summer. Land with a uniform cover of tall grasses was supplied with water to much greater depths, and offered favourable conditions for plant growth for a longer period. A mixture of short and tall grasses indicated intermediate conditions of water supply. More detailed study showed that the areas of greatest agricultural value were those with a wire-grass (*Aristida longiseta*) vegetation, an association very rich in both shallow-rooting and deep-rooting species. The conditions indicated are a fairly deep, pervious soil capable of absorbing all the rainfall and heavy enough not to blow badly when broken. Sampson [73] points out that the pioneer settlers selected short-grass in preference to wire-grass land for farming because the soils appeared to resemble those with which the settlers had become familiar in the east. Of almost equal value to the wire-grass association were certain phases of the grama-buffalo-grass vegetation in which *Bouteloua oligostachya*, *Buchloë dactyloides* and *Psoralea tenuiflora* were dominant. Areas characterized by other associations—e.g., the *Gutierrezia-Artemisia* association, lichen formation, and species associated with " blow-outs "—were defined as less fit or unfit for agricultural purposes. These occupied

mainly bare, rocky or alkaline land which could usually have been adjudged non-agricultural without reference to plant indicators.

As might be expected, within an area of uniform climate there was good correspondence between vegetation and soil texture (referred to by Shantz as soil type), but the correspondence broke down in areas of varying climate. The modern conception of soil type embraces both climate and texture, and a wider and more general correspondence between vegetation and the soil types now distinguished would be anticipated.

Shantz concluded that differences in the vegetation could be used to indicate changes in one factor of the environment only when all the other factors remained unchanged, and that indications of soil moisture were more easily obtained than of any other factor. In this connexion it should be borne in mind that Shantz was working in a region where lack of moisture was the prevalent limiting factor.

Aldous and Shantz [2] developed a complete system of use-capability land classification based on the natural vegetation for the semi-arid region of the United States west of the 100th meridian. When the classification was started settlement was so recent over much of the region that no agricultural history was available, and climatic data were also lacking over many areas. 102 vegetation types (plant communities) were distinguished, and classified into two major categories (1) dry-farm land, capable of producing cultivated crops without irrigation, and (2) grazing land, on which pasture or the natural vegetation was more valuable than possible cultivated crops. (1) was further subdivided into good, bad and indifferent (a) grain land and (b) forage land, and (2) into good, bad and indifferent pasture. We have not come across any record as to whether or not this twenty-year-old classification has proved its worth in practice.

Hilgard [34] lists the following plants which when growing in dense stand in California, indicate a soil alkalinity too great for cultivated plants :— tussock grass (*Sporobolus airoides*), bush samphire (*Allenrolfia occidentalis*), dwarf samphire (*Salicornia subterminalis*), saltwort (*Suaeda torreyana*), greasewood (*Sarcobatus vermiculatus*), alkali-heath (*Frankenia grandifolia campestris*), cressa (*Cressa truxillensis*), salt grass (*Distichlis spicata*).

St. Clair-Thompson [72] suggested that plant indicators could be used to determine the suitability of forest land for cocoa in the Gold Coast. He distinguished four types of climatic forest climax in the Gold Coast. These were :—

(1). Rain or evergreen forest—*Cynometra-Tarrietia* association. Cocoa does not thrive, possible owing to lateritization of the soil.

(2). Wet mixed deciduous forest—*Lovoa-Guarea-Pentadesma* association. Cocoa thrives, except in edaphic climaxes dominated by *Lophira*.

(3). Moist mixed deciduous forest—*Khaya-Entandrophragma* association. Favourable for cocoa cultivation.

(4). Dry mixed deciduous forest—*Triplochiton-Cistanthera* association. Cocoa cultivation highly speculative.

Lengthy lists of indicator species for each climax are given, for details of which reference must be made to the original paper.

The assumption often made by pioneer settlers that the more luxuriant the tree growth the greater will be the productivity of the soil under cultivated crops needs to be qualified under certain conditions—e.g., a tropical rain forest may indicate a lateritized soil incapable of producing more than one or two crop harvests. Again, the policy of " settling men where the big trees grow " proved disastrous in Victoria where the big trees were required to protect the watershed of the Murray River [21].

After reviewing the evidence available Sampson [73] concludes that " the character of the natural plant cover may serve to segregate virgin lands into categories favourable or unfavourable for crop production. The reliability of such guidance, however, is roughly proportional to the knowledge of the ecological relations between the native vegetation, the cultivated crops, and the environmental complex."

The intuition of an experienced observer who has taught himself to interpret the indications of vegetation and soils can often provide more reliable estimations of the performance of land under cultivation than any rules of interpretation that can be expressed in words.

Plant indicators of forest-site quality

Cajander [11] states that there are two kinds of forest classification, based either on some characteristic of the stand or else on the natural qualities of the site. Stand classifications are based on the yields of the stands, which may vary greatly on similar sites according to the tree species, management of the forest, etc. These classifications are quite subjective. Site classification, on the other hand, is objective, in that it represents an attempt to combine into one class all areas with the same capacity for growing timber, irrespective of what they are actually producing.

The principle of Cajander's system is that the inherent quality of a forest site is expressed in the nature and composition of the ground flora, and can be defined by the presence or predominance of certain indicator plants which are, in fact, indices to soil conditions. The main soil groups will be indicated by the tree species, but the important variations within any group will be indicated by the ground flora, and in such a way that if, say, any three plant associations under a given tree species represent descending grades of site quality, they will do so in the same order wherever they are found under any kind of forest.

A complete classification of Finnish forest types has been developed from these principles ; it is considered sufficiently reliable to be used widely in State assessments of forest-land values.

The classification can only be applied to mature and normally developed forests in which the natural vegetation has not been disturbed by human interference.

The following are the most important types distinguished in the Finnish softwood forests. They are given in ascending order of site quality.

Cladina type. Occurs on very dry pine heaths, with a thin layer of raw humus. The ground is usually greyish white, owing to the abundance of lichens (especially *Cladonia alpestris*).

Calluna type. *Calluna vulgaris* is usually the dominant species in the ground flora, accompanied by a rich moss and lichen vegetation. Pine is the most common forest species, but spruce and birch frequently occur as admixtures, and occasionally as dominants.

Vaccinium type. Moss vegetation is continuous, and lichens are common ; grasses are fairly abundant. The dwarf-shrub vegetation is dominated by *Vaccinium vitis idaea*, accompanied by *Myrtillus nigra* and *Calluna vulgaris*. The forest is usually pine, but spruce and birch may be dominant (more frequently than in the *Calluna* type), and occasionally alder (*Alnus incana*).

Myrtillus type. Herb vegetation is abundant, with *Myrtillus nigra* dominant, and nearly always accompanied by *V. vitis idaea*. There is a luxuriant moss cover (*Hylocomium* and *Dicranum* spp.), but lichens and grasses are unimportant. Spruce is the natural forest species, but pine, birch, alder and poplar also occur.

Oxalis-Myrtillus type. Mosses are scantier, but herbs and grasses are more abundant than in the three preceding types. The herbs and grasses contain many hygrophilous species, in particular, wood sorrel (*Oxalis acetosella*) which gives its name to the type. Exacting bushes, such as *Rubus idaeus*, *Daphne*, etc. are often present. Besides the common species of softwoods, a sprinkling of hardwoods may be met with, including ash, maple and oak (*Q. pedunculata*).

Oxalis-Majanthemum type. Thin-leaved herbs and ferns (e.g., *Oxalis acetosella*, *Majanthemum bifolium*) and flowering plants such as violets are abundant. Mosses, grasses and dwarf shrubs are common, but not abundant. Spruce would be the only dominant tree species in virgin forests, but in Finland, owing to burning, cutting, etc. large areas are covered by birch, alder, poplar and other hardwoods.

The recognition of the different types is an art which can only be acquired by practice. The appearance and composition of the soil cover change with the time of year, but with the more well-defined types an experienced observer has no more difficulty in placing them than a botanist has in determining a plant species at different stages of growth.

That there is a close connexion between this purely ecological classification of forest types and both the actual yield capacity and soil properties of a locality has been demonstrated by several Finnish workers. Cajander's theory of forest type assumes that in all areas of the same type the combined action of climate and soil is equivalent, and consequently within one climatic region differences in type must be due to differences in soil properties. Table 1, compiled from figures representing averages of several hundred samples, shows how certain soil properties are connected with the forest type. The figures, except for soil reaction, are relative, taking those for the *Myrtillus* type as 100, and refer to the top 20 cm. of soil.

TABLE I

Yield figures and selected soil data relating to Finnish forest types [11]

Type	Relative yield (75-year old pine)	Loss on ignition	Amount of electro-lytes	CaO	P_2O_5	K_2O	N	pH
Cladina	27	49	44	36	161	118	34	3.6
Calluna	52	88	84	54	118	96	64	4.2
Vaccinium	83	81	55	79	161	100	71	4.6
Myrtillus	100	100	100	100	100	100	100	4.8
Oxalis-Myrtillus ...	115	117	159	117	54	109	137	5.2
Oxalis-Majanthemum	—	143	157	140	28	114	223	5.0

Cajander's ideas are most readily applicable in countries like Finland, where climatic conditions are comparatively uniform. His system has not been found so suitable for forest assessment even in the neighbouring country of Sweden. There a closer connexion has been found between forest type (vegetation) and stage of soil formation (podzolization) than between forest type and forest yield. The different vegetation types influence the leaching process caused by water percolation in the soil to markedly different degrees, due to the quality of the humus layer they produce. The strongest leaching is exercised by the *Myrtillus* type, then by the *Vaccinium* type, and the weakest by the *Cladina* type [88]. Usually, therefore, but not always, similar vegetation types are associated with the same soil type.

Hilgard [34] found, as might be expected, a general relationship between soil quality and the nature of the indigenous tree flora. Certain tree species, e.g., *Quercus minor* and *Q. marylandica*, appeared to grow equally readily on rich and poor soils, but in such cases the trees tended to assume characteristic and different shapes according to the quality of the soil. The shape was believed to reflect the lime content of the soil.

Coile [14] considers that the fundamental hypotheses behind the use of ground vegetation for evaluating forest sites—namely, that the ground vegetation reflects the inherent quality of the site better than does the tree vegetation, and that forest types so distinguished are largely independent of the composition, age and density of the forest stand—are open to question except under special conditions of climate and topography. Because the ground vegetation does not have so extensive and ramifying root systems as trees, it is unlikely fully to reflect the conditions under which the trees are growing. Moreover, the assumption that the nature of the ground vegetation is independent of that of the tree species has obviously only a very limited validity. But enough evidence has been collected to show that certain ground-vegetation types are associated with the more fertile, and others with the less fertile, forest-soil conditions. Such differences in fertility are, however, as easily associated with readily distinguishable topographical or soil characteristics as with the ground vegetation.

The use of indicator vegetation types as an aid in the selection of tree species to plant on open land falls into a different category, and is justified where experience has shown that certain types are specific to certain sites on which a given tree species is known to thrive. It may happen, however, that the climax species indicated by the ground vegetation will not thrive when planted directly onto open ground, owing to differences in microclimate between open and forested sites. The ground vegetation may indicate the climax, but not the intermediate ecological stages which may need to be traversed before the climax is reached.

Hesselman [32] has shown that certain herbaceous plants are indicative of specific soil conditions—e.g., *Epilobium angustifolium* and *Rubus idaeus* indicate high nitrifying capacity in Sweden. He suggested that the ground vegetation indicated the kind of treatment required rather than the inherent quality of the forest site.

Under the conditions prevailing in the United States Coile concludes that "if a classification of forest sites is desired, it should be based upon fundamental and permanent features of site, namely soil and relative topographic position of the soil mass. Characteristics of the soil mass, the substratum, and topography, which are related to the availability and total volume of water present for use by forests, should be the primary criteria in any classification of site." Markedly different chemical characteristics of soil may be secondary criteria of classification. In regions of appreciable relief, and in northern regions with less relief, aspect of land should be brought into the classification. The following characteristics of site should be considered.

1. Aspect.
2. Relative topographic position and slope.
3. Texture and thickness of the surface soil or A horizon.
4. Texture and thickness of the B horizon.
5. Nature of the substratum or soil parent material and its depth if relatively shallow."

The classification envisaged is apparently one in which the site factors enumerated would be evaluated and awarded "points" after their significance had been determined from existing forest stands.

Grassland indicators

On most pasture and range land indicators express the present condition of the land resulting from past treatment rather than its inherent or potential productivity, though indicators do express the latter in some degree on virgin grassland. "Range indicators" says Taylor [89] "are the clues to range happenings. All that can be used as guides to recognition of the real state of affairs—non-use, satisfactory use, abuse—either in the past or present, may be classed as indicators." Indicators, not solely plant indicators, are often specific to certain localities, and generalizations are impossible, but certain general observations can be made about the indication of range deterioration [73].

Range deterioration well under way is shown by : weakened vitality of the principal forage plants ; limited, or the absence of, reproduction of the most palatable species ; close grazing of species of low palatability ; a thinning ground cover of the entire vegetation ; replacement of the good forage plants by those regarded as of little value ; evidence of relict forage plants ; incipient gullying and evidence of increasing soil erosion. Evidences of past range damage are : a relative absence of formerly abundant forage plants ; foliage and branches of the taller browse plants trimmed back as high as the animals can reach ; dead remnants of the browse species of low stature ; abnormal abundance of those species which persist and reproduce after more palatable species have disappeared ; accelerated soil erosion accompanied by numerous V-shaped gullies. Indicators resulting principally from unsatisfactory soil conditions that may be used in conjunction with other indication are : truncated soil horizons ; lack of a normal amount of organic soil between groups of herbs or shrubs ; the conspicuous presence of hummocks, indicating general erosion in the absence of gullies. Doubtful or less reliable indicators of a deteriorating range are : local denudation of the soil, sometimes caused by soil slipping or displacement, or by congregation of herbivores on a restricted area ; increase in poisonous plants resulting from a favourable successional reaction ; general appearance and condition of the grazing animals, as where overstocking of an area for a single season is the principal contributing factor ; condition of the timber reproduction, such as damage from defoliation or destruction of the " leader " by insects.

These observations refer mainly to conditions in the western United States.

A good deal of work has been done in Germany, Switzerland and Scandinavia [54] on the estimation of site quality of meadows and pastures by the composition of the herbage association. The general inference from much of this work is that the plant association reflects most clearly the moisture condition of the habitat, and rather less clearly the reaction and nutrient content of the soil. The investigations have considerable ecological significance, but it is unlikely that they will have much application to practical problems of land classification. The indicator plants are used to classify the meadows or pastures as productive assets rather than the land. Thus Petersen [69] distinguished six meadow types by the dominance of certain grasses in the meadow. The best class contains meadow foxtail, meadow fescue, timothy, canary grass, manna grass, meadow grass. A middle class contains quack grass, soft brome grass, meadow grass. The lowest class contains sedge grass, *Scirpus*, *Deschampsia*, sheep's fescue. A definite hay yield, both quantitative and qualitative, is associated with each class ; one centner of good hay is reckoned as equal to two centners of poor hay. The highest class yields 100 dz./ha.

Pentz [67] states that the success of any particular type or system of farming in South Africa is closely related to the type of vegetation on the area. Experience has shown that successful farmers are those who have

adapted their farming to the natural vegetation. Much of the current maladjustment of South African agriculture to the environment has been the result of booms and subsidies (e.g., on maize) which have encouraged the wrong kinds of farming. "In the majority of cases where there has been a boom, the areas which were suited to the production of the commodities required have suffered very little, except from the high valuation of land. It is those areas where conditions were not suitable for economic production that most damage was done to the land and vegetation, and where most failures occurred."

Pentz maintains that the only sound foundation for South African agriculture is to apply farming systems on the vegetation types to which they are suited, and this can only be done by a detailed botanical survey of the country. In such an experimental survey of the Estcourt (Natal) area the following points were observed :—(1) number of vegetation types ; (2) area of, (3) climatic conditions and (4) soils and topography associated with, each type. An investigation was conducted into present and possible farming systems, and their effects on the land and costs (*a*) in relation to each vegetation type, and (*b*) in relation to a combination of types in order to determine whether together they could form a complete farming unit.

Four main types were distinguished—thorn veld, tall-grass veld, highland sourveld and mountain veld. A careful study of all conditions prevailing on the thorn veld ruled out crop, sheep or dairy farming, and pointed to cattle farming as the most suitable system. Ordinary ranching, however, would require too much land, and stock breeding is recommended as the most suitable on both ecological and economic grounds. The tall-grass veld is likewise cattle land, although with its open plains and well-distributed rainfall it appears ideally suited to crop farming. It has, however, shallow and erodible soil, and can only be safely cropped on intensive and highly scientific lines. The vegetation, topography and climate indicate a seasonal type of husbandry, i.e., grazing the veld in the summer and carrying the animals through the winter with hay and silage produced from surplus summer growth. The highland sourveld has a very severe climate, and stock farming depends on the quantity of food that can be conserved from the veld during the summer to carry the stock through the winter. Sheep farming is a possibility, but it is suggested that the land is better suited to the intensive production of beef types. Both here and in the thorn veld the farmer would dispose of every animal, except breeding stock, as soon as possible. The mountain veld is unsuitable for farming, but contains the head waters of the rivers, and must be protected from denudation if farming in the areas below is not to suffer.

Pentz states that by thus adapting farming to the vegetation the whole area could be organized as a complete unit for beef production, so that each farmer could farm without exploiting his land and have a ready market for his produce. The highland sourveld would produce breeding stock for the breeder in the thorn country who would produce weaners for sale

to the grazier in the tall-grass veld who would supply a well grown-out animal ready for feeding for export.

In the above example, only potential grazing land is considered, but there is no reason why similar ecological indications should not be used to determine the use capabilities of potential crop land.

Systems of Land Classification

There follow descriptions of several systems of land classification, selected to indicate the points common to all systems and points peculiar to each system. The most obvious common point is the acceptance of some measure of soil productivity as the basis of the classification. In the systems described the differences in soil productivity between classes are mainly qualitative—i.e., class I is described as either better or worse than class II, or they are described merely as classes without indicating any relationship between them. The types and objectives of the classifications in this section may be described briefly as follows.

1. Physical classification correlated with economic data.
2. Land-capability classification for soil conservation.
3. Fractional-code method. Physical and social inventory.
4. Economic classification according to attainable intensity of use.
5. Classification for extensive wheat production according to profitability.
6. Physical classification for land-settlement purposes, without regard to economic and social factors.
7. Classification by soil types according to inherent productivity.
8. Classification according to present use.
9. Classification for land-settlement purposes according to present use, yields and soil-moisture conditions.
10. Classification for irrigation purposes.

1. Michigan

The need for land-use planning in Michigan appeared acute after the first world war when a large and increasing area of land in the northern part of the State became idle, and forest fires were frequent and unchecked. The importance of the land inventory as a prerequisite to land classification and planning was clearly recognized in developing land-classification procedure [50]. The Michigan Academy of Science, after much deliberation, decided that a land classification must precede the operation of any land planning, and that the classification must be based on a factual inventory of all the essential items on which the intelligent utilization of land should be based. The first emphasis was laid on the economic aspect, as confidence was waning in the methods and points of view of technical agriculturists who " had permitted confidence in their technical skill, and undue optimism—if not illusion—as to the economic practicabilities of agriculture, to bolster the assumptions, allegations and subreptions of professional land-boomsters " [50].

The Land Economic Survey was set up in 1922 as a branch of the State Department of Conservation. Its specific purpose was to inventory facts; it refused to make land classifications to be used as a basis for land-use recommendations. The facts collected were those pertinent to the understanding of problems relating to forestry, agriculture and recreation, the three major land uses in the area surveyed. Data were collected on (1) population distribution and changes, (2) political organization and changes, (3) assessed valuations and tax rates, (4) tax delinquency, (5) land ownership and intent in ownership, (6) economic activities, trade and trade areas, (7) miscellaneous data.

The data of the Land Economic Survey are reported to have been of great use in connexion with matters such as the establishment of State forests, the determination of acquisition policies and land-use planning, but by themselves they do not form an adequate basis for a land classification. For this purpose a more rapid, simple and less detailed determination of land types was required. The concept of the "land type" as a unit of inventory and classification, consisting of various unique combinations of soil types, relief and drainage features and topographic forms, has been much developed by Veatch [95, 96] at Michigan State College of Agriculture. Obviously, the number of combinations of physical features is almost infinite, and the art of the land classifier consists largely in defining the prototypes and relating the innumerable variants to those. Veatch [96] lists the following as types of land or combinations of natural conditions that have influenced the determination of present land use and farming systems in Michigan.

1. Uniformly smooth or level land with fertile, durable soils dominant, but in combination with smaller bodies of less fertile but arable land. Such land can be laid out in large rectangular fields, and large machinery units can be used advantageously.

2. Arable soils and level land associated in small bodies with hills and slopes. The soils vary distinctly in fertility, moisture content and crop adaptations.

3. Uniformly level dry surface in combination with sandy soil of low fertility.

4. Uniform mineral soil dotted with peat depressions and lakes, or peat and muck swamps dotted with ridges and hills of dry mineral soils.

5. Fertile soils, excessively stony, in combination with steep slopes or poor drainage.

6. Arable rolling land with gentle or moderately steep slopes containing a dominant amount of productive loams, but with small bodies of inferior soil.

7. Uniform soils, medium fertility, lying on level dry plains, dotted or intersected with lakes and swamps.

8. Complex associations of wet and dry soils which are dominantly low in productivity. The land is smooth or has only low relief features.

9. Hills or dunes of deep infertile sands subject to shifting by the winds.

The land type usually embraces several soil types. A descriptive inventory of a land type (taken from the legend of Emmet County land-type map) reads as follows:

Brutus land type.—Vegetation (Major) maple, elm, aspen, ash, hemlock (Minor) cedar, spruce, balsam. Surface, level and gently rolling. Soils (Major) Selkirk, Brimley, Ogemaw (Minor) Saugetuck, Newton, Rubicon. Drainage, slow to poor.

Land types are first determined by reconnaissance field observation, and afterwards delineated with reference to soil types from standard soil maps. Individual soil types are not, however, distinguished within a land type on the land-type map. It will be seen that the type is essentially an inventory of physical conditions significant to land use. Its primary purpose is to provide a simple and intelligible presentation of soil data by grouping soil associations and their physical characteristics into units applicable to planning purposes. It is claimed that such grouping forms a rational physical basis for correlation with economic and social data.

2. U.S. Soil Conservation Service

The conservation surveys of the U.S. Soil Conservation Service involves the mapping of four main land characteristics—soil, slope, condition of erosion and present use [62]. Soils are mapped by the standard methods of the U.S. Soil Survey, each soil type being allocated a number in the map legend. Slopes are measured in percentages and grouped into percentage ranges which vary with the erodibility of the soil. Thus the slope classes of two different soils (No. 1 being the more erodible) have the following significance :—

Soil No. 1		*Soil No. 2*	
Slope class	*% slope*	*Slope class*	*% slope*
A	0–3	A	does not occur
B	3–8	B	,, ,, ,,
C	8–15	C	15–25
D	15–25	D	25–35
E	does not occur	E	35 and over

Erosion conditions are expressed by numerical symbols indicating the kind and degree of erosion. The symbols are standard for the Soil Conservation Service, e.g., 3 indicates 25–50 per cent, 33 indicates 50–70 per cent, loss of topsoil, 7 indicates occasional gullies more than 100 feet apart. Land types are distinguished by a three-part symbol, the first part of which refers to the erosion conditions, the second to the slope and the third to the soil type—e.g., 337–B–16. A new land type is mapped wherever one part of the symbol changes. Present land use is mapped separately and is indicated by capital letters—L cropland, H farmsteads, P pastures, F woodland, X idle land. Present use is not here involved in the land classification, but it shows to what extent the land is being inadvisedly used and where readjustments are required.

On the basis of the three characteristics—soil type, slope and erosion conditions—land is classified according to its use capability or suitability for agricultural use. Eight classes are distinguished [36] :—

Suitable for cultivation with

I. no special practices ;
II. simple practices ;
III. intensive practices.

Suitable for occasional or limited cultivation with

IV. limited use and intensive practices.

Not suitable for cultivation, but suitable for permanent vegetation with

V. no special restrictions or practices ;
VI. moderate restrictions in use ;
VII. severe restrictions is use.

Not suitable for cultivation, grazing or forestry

VIII. usually extremely rough, sandy, wet or arid land that may have a value for wildlife.

These use-capability classes are defined very generally to begin with, and sharper definitions are given in accordance with the conditions and practices prevailing in the region being surveyed. The classes are determined solely on the basis of physical characteristics of the land, i.e., of the soil and climate [64]. The chief characteristics are (1) susceptibility of the soil to erosion when cultivated, (2) natural soil productivity, (3) factors interfering with cultivation, e.g., stoniness, hardpan, (4) climate, particularly temperature and precipitation.

As an illustration of the factors considered in determining a land class [36] Class-I land is described as " land highly suitable for cultivation, for it does not have a permanently high water table ; neither is it stony or spotted with rock ledges ; nor does it possess any other physical characters which interfere with the use of tillage implements. Furthermore clean-tilled crops like corn, cotton, or tobacco, the growing of which is often likely to result in soil washing, can be raised on this land without danger of appreciable erosion. Finally, it retains and supplies sufficient moisture and plant nutrients to maintain those physical, chemical, and biological conditions of the soil that favor continued production of moderate to high yields of farm crops."

" Special practices " apparently include any conservation measures such as rotations, strip cropping, terracing, drainage, not ordinarily used in the locality. A simple rotation that is customary in one place is not a special practice, but the same rotation where it is not customary is a special practice.

Field mapping is usually done on aerial photographs in detailed conservation surveys on a scale of four inches to one mile. Smaller scales are used for reconnaissance surveys.

A trained soil surveyor determines and maps the soil, slope and erosion conditions, but the actual classification or grading of the land types mapped is the result of consultation between surveyors, planning technicians, agricultural scientists and farmers.

This type of land classification is exceptionally easy to translate into land-use recommendations. Table 2 illustrates how this is done [62].

TABLE 2

Use recommendations based on use-capability classification

Land-use capability class	Land use	Cropping systems	Supporting conservation practices	Soil treatments
I.	Cultivation	Row crop 2 years, small grain, hay	None	Manure
II.	do.	Row crop, small grain, hay	Contour strips, 75′-125′, or terraces	Lime+manure
		Row crop, small grain, hay 3 years	Contour cultivation	do.
		Row crop, small grain, hay 4 years	None	do
	Pasture	None	None	do.
III.	Cultivation	Row crop, small grain, hay	Contour strips and terraces	do.
		Row crop, small grain, hay 2 years	Contour strips, 60′-100′	do.
		Row crop, small grain, hay 4 years	Contour cultivation	do.
	Pasture	None	None	do.
IV.	do.	None	Controlled grazing. Contour furrowing for adapted soil, slope and vegetative cover	Lime+phosphorus
	Woodland	None	Protection and management	None
	In case it is necessary to cultivate Class-IV land, special intensive practices will be planned to meet the conservation needs.			

The systems recommended in the third column are determined not only by the land class, but also within limits by the capacity and preferences of the occupier of the land.

The type of classification described might be defined more correctly as of soil rather than of land. It is a classification with a definite and limited objective—the control of soil erosion. Factors like inherent fertility, crop adaptability and economics are only incidental, the overriding consideration in using the classification for land planning being whether or not the adoption of a certain practice will result in erosion or, more generally, soil deterioration. There are, however, very large regions all over the world where erosion control must now be the primary purpose of land planning, and for such regions a relatively simple land classification, similar to that used by the U.S. Soil Conservation Service, should be useful.

One might with some justice describe the purpose of a soil-conservation survey to be planning for permanent settlement. It is a straightforward, easily defined objective. Without adequate soil conservation permanent

settlement and long-range land planning become impossible. A land classification based on the requirements of soil conservation should therefore constitute at once a "fundamental" and a "practical" classification—practical because it considers the economic and technical aspects of land utilization, and fundamental because it relates these to the limitation imposed by the natural environment. In Western Europe which, as Eisenhower [19] has stated, is the only developed region of the world that is practising total soil conservation, the pre-war pattern of land use was the resultant of farming systems evolved primarily for soil conservation and modified within the soil-conservation framework by economic, political and social factors. It seems inevitable that those countries which are attempting consciously to plan their evolution towards the settled state must also base their land-use planning primarily on soil conservation. The land classification here described has the great merit of simplicity of determination and expression of land classes, and might serve as a model for many other classifications with the same or a similar objective.

The land-capability classification is fairly permanent, but changes either in the land (caused, e.g., by erosion) or in the methods of use or protection (e.g., irrigation developments, drainage, erosion control) may make reclassification necessary.

With the aid of a land-capability map, a present-use map and a recommended-use table as given above it is a fairly simple matter to replan land use on a conservation basis. Figs. 1 to 3 show how this was done for a farm in South Carolina [36]. Normally, of course, a farm is not planned independently, but in relation to the physical nature and use of surrounding land.

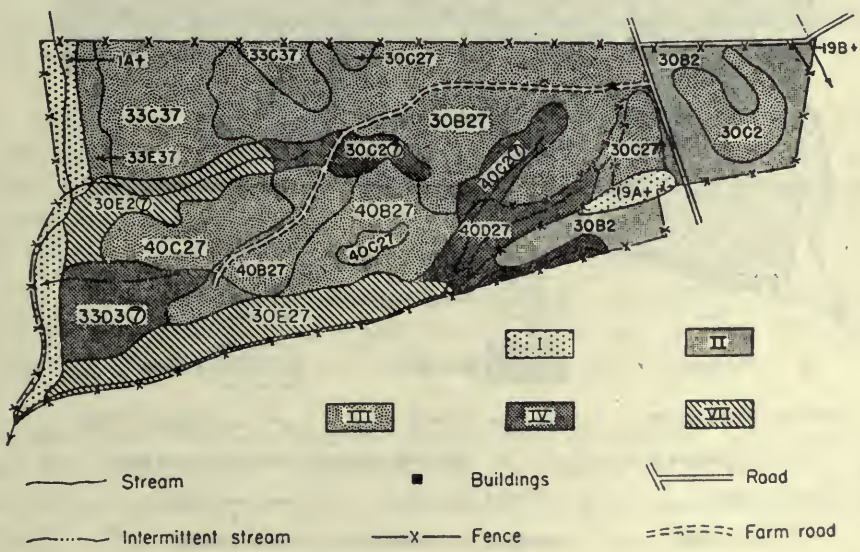

FIG. 1.—Land-capability map of a 151-acre farm containing land of Classes I, II, III, IV, and VII. Symbols show the soil types, slopes, and erosion classes. Soils are: 1, alluvial soils, undifferentiated; 19, Seneca sandy loam; 30, Cecil sandy loam; 33, Cecil clay loam; and 40, Appling sandy loam. Slopes are: A, less than 2 per cent; B, 2–7; C, 7–10; D, 10–14; E, 14–25; and F, 25 or more. Erosion classes are: +, alluvial land along streams; 2, sheet erosion, 25 to 75 per cent of topsoil removed; 27, the same with occasional gullies; 37, sheet erosion, more than 75 per cent of topsoil removed, and occasional gullies. A circle around a gully symbol indicates gullies too deep to be crossed with tillage implements.

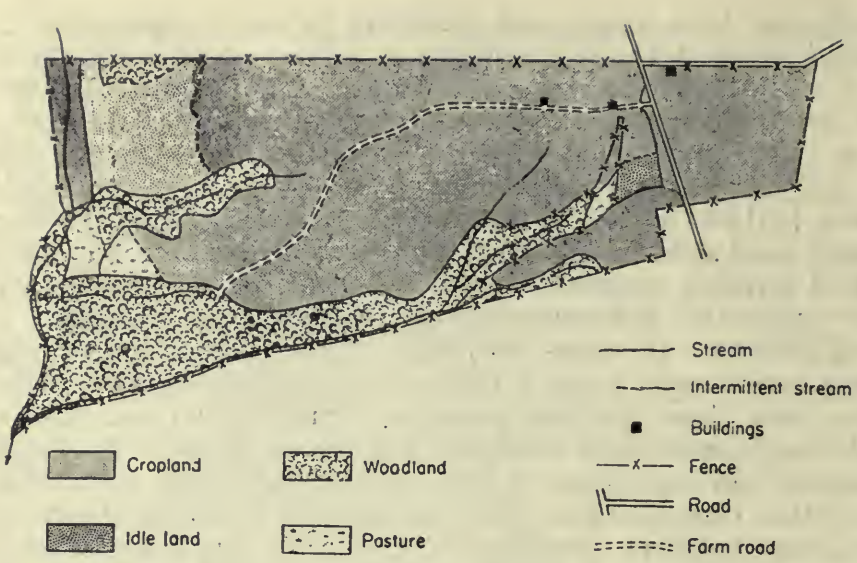

FIG. 2.—Land use on the farm shown in Fig. 1 before the new farm plan was made.

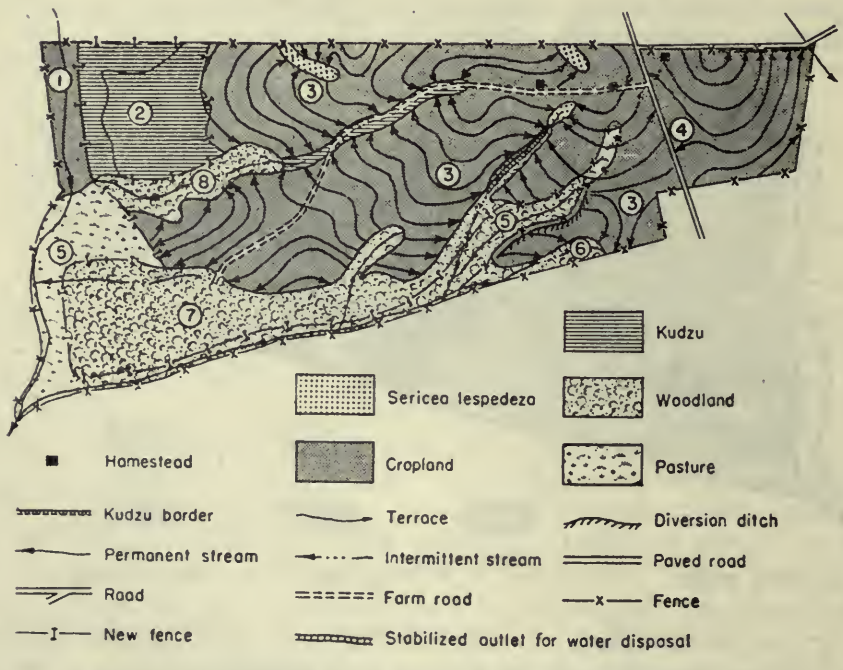

FIG. 3.—Land use in the farm-conservation plan.

3. Tennessee Valley Authority

The unit-area method of land classification has been developed by Hudson [38] and collaborators for use by the Land-Classification Section of the Tennessee Valley Authority. It represents an attempt to bridge the gap between methods of detailed field analysis and of reconnaissance. The T.V.A. required a method of land survey by which the whole Tennessee Basin could be rapidly and accurately covered. The best reconnaissance methods were too general to yield adequate data ; other methods were too slow and expensive [62].

The method finally evolved is an adaptation of the fractional-code method—i.e., the qualities of the land significant in planning are represented by digits, one set of digits relating to physical conditions composing the denominator, and another set relating to " human " conditions the numerator, of a fraction which describes and defines the land class. In the unit-area method fractional-code notations are applied to land units of not less than 200 acres. It aims at giving " an accurate quantitative portrayal of the occupancy pattern ".

The complete symbol of a land unit comprises three parts, namely, a long fraction, a short fraction and a Roman numeral, e.g., $\text{II}\ \frac{3}{3}\ \frac{2\text{D}323}{2331233}$.

Detailed classification has been made mainly of agricultural land, though the method can be extended, if required, to forest, urban, recreational and other areas.

For agricultural land the physical conditions of slope, drainage, erosion, stoniness, rock exposure, soil depth and soil fertility are first determined. These are expressed in the above order and according to the criteria given in Table 3 as the digits of the denominator of the long fraction. The unit is then classified on the " human " or cultural features of major agricultural use, agricultural emphasis, field size, amount of idle land, and quality of farm buildings and equipment (Table 4). The corresponding digits comprise the numerator of the long fraction.

The short fraction is a summary of the long fraction. The denominator represents the judgment of the field man, based on all observable physical factors, whether recorded or not, as to which of five quality classes the land unit belongs ; the numerator likewise represents the field man's judgment of quality class based on observable cultural data. In Tables 5 and 6 only the criteria for assessing classes 1 and 5 are given for the sake of brevity. From these the close relationship between the short and long fractions will be apparent.

TABLE 3

Major land uses or " human " items on the basis of which homogeneous land uses are delimited. Noted by the digits in the numerator of the long fraction

First Digit	Second Digit	Third Digit	Fourth Digit	Fifth Digit
Major Land Use	Agricultural Emphasis	Field Size	Amount of Idle Land	Quality of Farmsteads and Equipment
1. General farming	A. Corn	1. Large	1. Little	1. Excellent
2. Animal industry	G. Grain (small)	2. Medium	2. Limited	2. Good
3. Cash-crop farming	B. Beef cattle	3. Small	3. Considerable	3. Medium
4. Part-time farming	D. Dairying	4. Very small	4. Excessive	4. Poor
5. Subsistence farming	S. Sheep			5. Very poor
6. Forest land	H. Hogs			
7. Recreational area	M. Mules and/or horses			
8. Rural-village area	P. Poultry			
9. Urban area	T. Tobacco			
0. Manufacturing and mining areas	C. Cotton			
	W. Truck			
	O. Orchard			
	N. No emphasis			
	F. Forage			

TABLE 4

Major physical conditions of the land on the basis of which homogeneous units are delimited. Noted by the digits in the denominator of the long fraction

First Digit	Second Digit	Third Digit	Fourth Digit
Slope	Drainage	Erosion	Stoniness
1. Relatively level	1. Thorough	1. Little or no observable erosion	1. Free from stones
2. Relatively level to undulating	2. Adequate	2. Little denudation by erosion	2. Moderately stony
3. Undulating to moderately hilly	3. Poor	3. Sheet erosion and ephemeral gullies	3. Stony
4. Hilly	4. Very poor	4. Excessive sheet erosion and gullying	4. Very stony
5. Steep	5. Excessive	5. Excessive gully erosion	

Fifth Digit	Sixth Digit	Seventh Digit
Rock Exposure	Soil Depth	Soil Fertility
1. Little or no rock exposure	1. Deep (6 feet or more)	1. Exceptionally fertile
2. Limited rock exposure	2. Moderately deep (3 to 6 feet)	2. Fertile
3. Considerable rock exposure	3. Shallow (1 to 3 feet)	3. Moderately fertile
4. Excessive rock exposure	4. Very shallow (less than 1 foot)	4. Very low in fertility
5. Rock exposure barren		5. Very low in fertility

TABLE 5

Criteria for classifying land on the basis of the agricultural quality of present physical conditions
(denominator of the short fraction)

Class 1. Units of 200 acres or more that are characterized by the following physical indices, appearing individually or in combination: (1) level or moderately undulating surface; (2) adequate or thorough drainage; (3) little or no observable erosion; (4) deep stone-free soil of exceptional fertility; (5) little or no rock exposure.

Class 5. Units of 200 acres or more that are characterized by the following physical indices, appearing individually or in combination: (1) steep slopes; (2) very poor or excessive drainage; (3) denudation by sheet or gully erosion beyond the point of cultivation and economically feasible rehabilitation other than by reforestation; (4) shallow or stony soils, very low in fertility; (5) excessive rock exposure.

TABLE 6

Criteria for classifying land on the basis of the quality of the present agricultural use
(numerator of the short fraction)

Class 1. Units of 200 acres or more that are characterized by the following use indices, appearing individually or in combination: (1) medium and/or large uninterrupted fields; (2) fields free from weedy or brushy cover; (3) little or no idle land; (4) excellent farmsteads and farm equipment; (5) any other evidence of an excellent standard of living.

Class 5. Units of 200 acres or more that are characterized by the following use indices, appearing individually or in combination: (1) very small and/or interrupted fields; (2) sparse, weedy or brushy field cover; (3) excessive amounts of idle land; (4) very poor farmsteads and farm equipment; (5) any other evidence of a very low standard of living.

Finally, the land is put into one of five classes according to the severity or absence of problems and needs for readjustments. These classes are indicated by the prefixed Roman numerals I to V. "In part, these Roman numerals represent a summary of their accompanying short and long fractions; but again the entire complex in all its pertinent observable respects is carefully considered and appraised before the field judgment is made." The ten criteria for distinguishing each class are the same as the corresponding criteria given, for Classes 1 and 5, in Tables 5 and 6. The classes are briefly defined as follows:—

Class I. Units in which no significant agricultural problems are apparent. These units are characterized by an excellent standard of living and by land exceptionally well suited for both general and specialized types of agriculture.

Class II. Units in which the apparent agricultural problems are not critical, but can generally be solved by education and demonstration. The units are characterized by a good standard of living and by land well suited for general and specialized agriculture.

Class III. Units in which agricultural problems are moderately critical, but can be solved by intensive education and demonstration. Characterized by a medium standard of living and by land which can be used for general or special crops under proper management.

Class IV. Units in which agricultural problems are very critical, and can usually be solved only by a marked readjustment and/or reorientation of economic activities.

Class V. Units usually only suitable for forest use, alternatively for recreation, game preserves; also waste land. Characterized by a very low standard of living and by land unsuitable for agriculture.

The long fraction can be regarded as an inventory of the physical and agricultural conditions, the short fraction and the Roman numeral as assessments or appraisals of the inventory.

A new body of land is delimited whenever a change occurs in one or more of the items recorded. The fractions and numerals are recorded in ink on aerial mosaics, and subsequently each unit area is put into one of three general classes :—(1) land suited to intensive uses (with emphasis on cropping); (2) land suited to extensive use (with emphasis on pasture); and (3) land suited to non-agricultural uses. This classification is based on data not only from the unit-area survey, but from all other available sources.

Non-agricultural or forest land is classified and mapped simply by the appropriate figure 7, 8, 9, or 0 of the first digit of the numerator of the long fraction (Table 3). No further characterization is made. Forest land is identified by the numeral 6 in the numerator of the long fraction, and in the denominator the same seven physical conditions are noted as for agricultural land, e.g., $\frac{6}{4122114}$. Forest types are not distinguished by the Land-Classification Section, as these are the concern of the Forestry Division of the T.V.A.

The suitability of this method of land classification and mapping for the Tennessee-Valley region is due to the fact that a considerable amount of detailed field work has been carried out, that aerial photographs are available as base maps, and that it is possible to conduct operations on a fairly large scale. The method has been successfully used, with the necessary modification in the significance of the digits, in New Zealand where similar favourable conditions for its application obtain [18].

4. New York State

Land-classification studies have been made of many counties in New York. Their main purpose has been to classify and map the land according

to its adaptability to different degrees of intensity of use. To plan a land-use programme on the basis of such a map it is necessary to have knowledge of the natural factors limiting intensity of use, the factors which have determined present intensity of use, and those chiefly affecting the economic status of the farming community. It has been shown that in New York commercial, social and financial amenities such as roads, electricity supply, schools and credit facilities have a preponderating influence on the intensity of land use. At the same time the growth of such amenities is much influenced by the quality of the land.

In the New-York system the lowest land class is numbered I, and is natural forest land so poorly adapted to agriculture that it has seldom—and then unsuccessfully—been cultivated. Class-II land is also better suited to forest, nevertheless much of it has been brought under cultivation. Classes III to VII are suited to continuous agriculture of increasing degree of intensity of use.

The first operation in making a land classification is the preparation of a " property-classification " map. Farms are classified, usually by inspection from a moving car, according to the *apparent amount and condition of the farm capital.* The main evidence is obtained from the size and condition of farm buildings, but the state of roads and the distribution of utility services and amenities are also taken into account. It is considered that farmers " are continually struggling to adjust their farming operations to the character of the land in such a way as to earn as much as they can and to accumulate the largest possible amount of capital. Variations in the amount and condition of the capital which experienced farmers have been able to accumulate and maintain on the land, therefore, measure the combined economic effect of lay-of-the-land, climate, soil, and markets, and are one of the most reliable indications of the intensity of use to which the land is adapted " [62].

A land-use map, indicating actual intensity of use, is then prepared. Maps of topography and soils, both being important factors influencing intensity of use, are also required.

The delineation of land-class boundaries is done primarily from the property-classification map which roughly indicates the amount of capital a land type is capable of accumulating. A first adjustment of the boundaries is then made with the aid of the topographic map, since the actual boundaries of land classes are more likely to correspond to topographic than to property features. Further adjustments are made in turn from the land-use map and from the soil map ; consideration of the distribution of soil types sometimes results in radical modifications of the land classes distinguished on the basis of property condition and present intensity of use. Finally, the land-class map is checked in the field against type of use, condition of buildings, topography, etc. It is stated that differences between land classes are usually immediately apparent to those who are accustomed to land-class maps, though not always to others.

The maps are supplemented by statistical data which show the quantitative differences between the land classes. Of particular significance are the differences between classes as indicated by comparative farm-business data. It has been found, for example, that the gross and net incomes of farmers on the better-class lands have been consistently higher than those on the lower classes since 1908, the earliest date for which farm-management data are available.

5. Western Canada

Land in the prairie provinces has two main uses—wheat production and grazing. The former has been and will probably continue to be the major use in Saskatchewan, though grazing may surpass it in Alberta [15]. Distinction between land classes is based on the quantity of wheat available for sale per quarter section, converted to net productivity. There are four steps in the classification :—

1. determination of gross productivity per quarter section of land ;
2. conversion of gross productivity into terms of net revenue ;
3. classification of parcels on the basis of certain ranges of estimated net revenue ;
4. modification of such classification on the basis of the characteristics of individual parcels.

Saskatchewan [79]. Each quarter section is assessed in the light of all relevant physical and economic information available, special weight being given to the history and past productivity of the land. It is assigned to one of five classes, class I being submarginal, class II marginal, and classes III to V increasingly favourable for wheat production.

The classification hinges on the definition of marginal land—class II. Marginal land is defined economically as "land which . . . would, if operated with average managerial ability, in a unit of average size and typical organization, be expected to pay expenses—including depreciation and taxes—and provide a living for the operator and his family. It would not yield sufficient to pay for the use of the land either as rent or interest."

Farm-management studies have shown that marginal wheat farming—i.e., so that the operator gets the cash equivalent of a hired man's wages—corresponds to a production of wheat available for sale of 350 to 475 bushels per quarter section. These are therefore taken as the lower and upper limits of productivity of class II. Class-I land produces less than 350 bushels available for sale ; class III from 476 to 720 ; class IV from 721 to 900 ; and class V over 900 bushels available for sale.

This initial classification shows the relative productivity not of specific land or soil types, but of quarter sections. In the final classification this is modified by taking into account factors such as the effect of physical land characteristics on farm economy, variability of yield, progress towards permanent settlement, and main causes of success or failure.

The productivity is calculated primarily from (1) the annual yields per acre estimated from data obtained for different soil types for the years 1921—1936 multiplied by (2) the number of acres of cultivable land per quarter section. 1.5 bushels per acre is deducted from the estimated yield to allow for seed and farm use, and it is assumed further that on the average 45 per cent of the total cultivable area will be used annually in the production of wheat for sale.

As might be expected, there is quite good correlation between these mainly economically determined land classes and the financial and economic status of the occupiers in each class. Thus the land class is quite closely reflected in the price paid for land, tax assessment per acre, condition of buildings, percentages of mortgages foreclosed, and percentages of privately-owned and owner-operated land within a class. These characteristics are clearly associated with the relative yields of wheat on the different land classes. The wheat yield is an expression of the land's economic performance, and the land-classification map based thereon would, with minor adjustments, become a land-price or tax-assessment map, for example. This, presumably, is its purpose. It is claimed that the classification gives a general picture of productive capacity, and would reflect with reasonable accuracy the relative productivity of the land in other uses than wheat. It is questionable, however, whether this would be so unless the other uses were operated on an economy similar to that of extensive wheat production.

There is apparently no close correspondence between the distribution of land classes and soil types. Sands and gravels predominate in classes I and II, while most of the heavy clays occur in class V. The purely economic criteria by which land classes are distinguished make it unlikely that any close correspondence should exist, since many other variable factors besides soil contribute to land's economic performance. To a limited extent it was possible to equate different combinations of soil and topographic conditions within a land class, e.g., in classes I and II very poor, coarse, alkaline flat and " blow-out " soils may be associated with a flat topography favourable for cultivation, or somewhat better loams with rolling or broken topography.

Alberta. A similar system of classification, and for similar purposes, has been used in Alberta where, owing to large and frequent fluctuations in weather and wheat prices, agricultural settlement and production have been very unstable. It is felt that the classification of the land on an optimal-use basis is the first step towards planning to establish greater rural stability.

The general approach to land classification is described by Stewart and Porter [83] as follows. " The use of land depends upon the decisions of individual farmers ; and the decisions of farmers depend on their expectations of the returns they can secure from land. Stable land use requires that, over a period of years, farmers can expect to meet their expenses, and secure for themselves returns sufficient to induce them to continue

production without expansion or contraction. Under given prices, and with prevailing methods of production, some land may be incapable of providing for these necessary costs (submarginal land) ; other land will be just sufficiently fertile to cover costs (marginal land) ; more fertile land will yield a net revenue over the essential costs. Land may therefore be classified on the basis of its estimated capacity to yield net revenue."

The classification used by Stewart and Porter is fundamentally an economic one, and depends on an estimate of the net revenue obtained from the land under wheat. The determination of the net revenue is the crux of the method. The classification assumes that the land is not in use, and that farmers are considering the contracts and payments they should make in connexion with securing the land.

The procedure of classification involves the following steps.

(a) Determination of a physical productivity rating for each parcel, based on (i) the average long-run yield of wheat for the soil type of the parcel, (ii) the acreage of tillable land, and (iii) the typical proportion of tillable land in wheat.

(b) Conversion of this measure of gross physical productivity into terms of estimated net revenue using (i) long-term average prices for wheat and other farm products, and (ii) a budget of costs derived from farm-management survey data.

(c) Preliminary classification on the basis of certain ranges of estimated net revenue. Four classes are distinguished :

Class I. Estimated annual production of marketable wheat per quarter available for sale less than 375 bushels, and estimated revenue less than costs (submarginal).

Class II. Estimated annual production of marketable wheat per quarter available for sale 375–517 bushels, and estimated revenue equal to a range of costs (marginal).

Class III. Estimated annual production of marketable wheat per quarter available for sale 518–795 bushels, and estimated net revenue up to $237 per parcel of 480 acres, and based on a wheat price of 92 cents a bushel.

Class IV. Estimated annual production of marketable wheat per quarter available for sale 796–999 bushels, and estimated net revenue of more than $237 and less than $411 per parcel.

This classification provides a uniform basis on which to compare parcels in widely scattered areas with significantly different general features. Modification of the preliminary classification of parcels is necessary to allow for particular features of individual parcels, for example, topography, stoniness, erosion, climate and other physical characteristics. Adjustments are based on descriptive notes made in the field, aerial photographs and re-examination in the field.

6. Ontario

Hills [35] has outlined a system of land classification applicable to land-settlement problems in a thinly populated, slightly developed region of the Great Clay Belt of northern Ontario. Owing to lack of communications and the density of the natural plant cover soil survey was impossible, and the area was mapped in land types distinguished according to the criteria of land form, geology, drainage, soils and natural vegetation. Related land types were grouped into land classes.

Nine land classes were established, distinguished by the Roman numerals I to IX. No qualitative significance attaches to these numerals. The classes are objectively determined. Thus " Land class No. I occurs on the better drained areas dissected by stream courses or on comparatively low ridges where heavier materials cover a ' core ' of rock-knob or glacial debris. In this class are found soil profiles exhibiting a considerable degree of podzolic leaching. Land classes II and III are half-bog soils with a maximum peaty layer of approximately 18 to 36 inches, respectively. Land class IV includes the deep peat or muskeg. Land class V is a complex condition in which variable depths of intermediate and heavy textured materials overlie the fluvio-glacial sands and gravels. Under average conditions, the heavier surface layers supply fertility, and the lower open layers provide good drainage with the result that the most productive soils are found in local areas within this type. Outwash materials of intermediate texture are included in Land class VI. Ridges of coarse sandy and gravelly materials constitute Land class VII. Although these deposits are similar to the underlying materials of Land class V, the soils are droughty and low in fertility because of the absence of the heavier surface layer. Fairly compact, loamy, till soils constitute Land class VIII while the outcrops of the Precambrian rocks, with their shallow mantle of light soil are mapped as No. X." For some reason, No. IX has been omitted.

The agricultural or forestal capabilities of these classes are being determined on the basis of physical data, present use and past experience—chiefly, it would seem, of experience. " For example Land classes I, II and portions of V have the highest agricultural potentials. Local conditions of soil drainage and climate in No. V are most favourable for the production of potatoes. Classes III and VI have only fair agricultural potentials. Few soils similar to those in Land class VII are used extensively for agricultural production in America at the present time. Land classes IV and X have practically no agricultural value. For forestal purposes areas of classes I and V indicate the best saw-timber sites. In the mature stands of black spruce on Land class II, 2-log trees (which make 32 feet of pulpwood) are dominant while 1-log trees are common on Land class III. Portions of Land class VII are good pine lands."

Political, economic and cultural factors do not enter into the determination of land classes or of their use capabilities, but come into operation in formulating a plan of development based on this land classification. The plan, for example, might be to develop the best classes of land first.

This would require modification in practice according to costs of development, proximity to social and economic services, pressure of population, market facilities, etc., in each area. The political factor of whether costs of and responsibility for development were assumed by public or private authorities would also affect the execution of the basic plan.

7. New Zealand

Grange [26] has attempted to classify land in the North Island, New Zealand, according to its inherent productivity, on the basis of the soil survey. The soils are firstly classified into genetic groups which are then subdivided into stages—young, immature, semi-mature, mature—and finally into series and types as in the American system. The stage subdivision is in effect an inherent-productivity classification within a genetic group, young soils being the most, and mature soils the least, fertile. The soil map itself has but limited practical use, as there are more than 500 different types in the North Island, but from it single-factor maps (e.g., of lime or phosphate requirement, erosion, texture) are being prepared which have a direct application to advisory work. The soil types have also been grouped into six fertility or use-capability classes, with special reference to pasture utilization, namely [63] :—

Class I.—Level or undulating land, not too elevated, with deep soils and favourable moisture conditions, and which are, or can be, converted into high-quality farming land.

Class II.—Ploughable land which can be converted into only fair- or medium-quality farming land on account of some limiting factor to productivity.

Group (a) : Soils in which moisture is a limiting factor.

Group (b) : Soils in which some other factor such as texture, structure, drainage, elevation, or depth of soil is a limiting factor.

Class III.—Ploughable land which has severe limitations to productivity and requires further investigation before development is attempted.

Class IV.—Hilly or steep land which will maintain grass pasture with little or no top-dressing. Both topsoil and subsoil are of high fertility, and erosion is not a serious problem.

Class V.—Hilly or steep land of moderate to low fertility. Light top-dressing is required to maintain a cover of grass, and careful management is necessary to prevent serious erosion.

Class VI.—Hilly or steep land which has severe limitations to utilization, such as low fertility or erodibility. This class is probably more suited to forest than to grass.

8. Great Britain

In a country of long and politically stable settlement, present land use (except in apparently abnormal periods such as wartime) constitutes a

natural basis for a land-planning classification. Such a statement implies that land planning is not required, or would not involve much drastic modification of present use, in a country which has enjoyed long political stability, and in general this is borne out by facts. The countries of Western Europe are politically the most mature and before 1940 seemed the most stable in the world ; they did not evince the same interest in land planning as the politically immature countries of the New World or of Central and Eastern Europe. A prolonged period of undisturbed national development allows an equilibrium to be approached between the numerous interacting forces affecting the utilization of the land. " In Britain much of the land has been settled and farmed for upwards of a thousand years, some of it for two thousand. The present utilization does therefore reflect the combined influence of the varied factors concerned : the physical factors of relief, soil and climate ; the more purely economic and social factors of markets, prices, transport, labour ; the historical factors of land ownership, local usage, tenure, and even tradition or custom. It is only when the attempt is made to analyse present land use by reference to only *one* set of factors that dangerous fallacies of interpretation may be promulgated " [81].

No nation-wide soil survey has been carried out, and the only comprehensive scheme of land classification is that adopted by the Land Utilization Survey of the University of London, and based originally on existing land use, i.e., during the period 1931–1938. This period witnessed the lowest intensity of land utilization since the Industrial Revolution. The land is divided into ten major types numbered 1 to 10. Whilst types 1 to 4 inclusive are land of high agricultural value, types 8 to 10 land of low agricultural value, and types 5 to 7 land of intermediate quality, there is not a steady gradation in utility and value from 1 to 10. First-class arable land and first-class grazing land may be equally valuable, but the two types of utilization require different physical conditions. Certain types primarily suitable to arable farming and crop production are distinguished by the addition in brackets of the symbol A (arable) ; others naturally suited to pasture or meadow are distinguished by the symbol G (grassland). Still others can serve in either utilization (A–G), but the poorer types of land agriculturally sub-marginal under most economic conditions are normally under heath, moor or rough pasture, and are given the suffix H (heathland).

The ten classes are grouped into three Major Categories, distinguished by the following characteristics of site and soil :

Major Category I—good-quality land

Site (1) not too elevated,
(2) level, gently sloping or undulating,
(3) favourable aspect.

Soil (1) deep,
(2) favourable water conditions,
(3) texture, mostly loams, but including some peats, sands, silts and clays.

Major Category II—medium-quality land

Land of limited productivity by reason of the unfavourable operation of one or more site or soil factors, e.g.,

Site (1) high elevation,
(2) steepness,
(3) unfavourable aspect.

Soil (1) shallowness,
(2) defective water conditions.

Major Category III—poor-quality land

Land of low productivity by the extreme operation of one or more site and soil factors. Four groups of extreme factors are recognized.

(a) extreme heaviness and/or wetness of soil, giving poor-quality heavy land or land in need of extensive drainage works ;
(b) extreme elevation and/or ruggedness and/or shallowness of soil, giving mountain moorland conditions ;
(c) extreme lightness of soil with attendant drought and poverty, giving poor-quality light land ;
(d) several factors combining to such an extent as to render the land agriculturally useless or almost so—such as shingle beaches or moving sand dunes.

The complete ten types and the estimated percentages of England and Wales occupied by each are :—

Major Category I—good		48.8
1. First-class	5.5	
2. Good general-purpose farmland—		
2 (A) Suitable for ploughing	20.3	
2 (AG) Crops or grass .	6.3	
3. First-class, restricted use, unsuitable for ploughing .	3.6	
4. Good but heavy land . .	13.1	
Major Category II—medium		31.4
5. Medium light land—		
5 (A) Suitable for ploughing	5.9	
5 (G) Unsuitable for ploughing	0.8	
6. Medium general-purpose farmland	24.7	
Major Category III—poor		16.1
7. Poor heavy land . . .	2.1	
8. Poor mountain and moorland .	11.5	
9. Poor light land . . .	2.1	
10. Poorest land	0.4	
Residue—closely built over . .		3.7

That present land use in Britain is, broadly speaking, indicative of land quality is shown by the remarkable constancy of land use over long periods of time on the best and worst types, and the maximum of change on the intermediate types. Historical records show that the best arable land has often remained under the plough almost continuously for a century or more, while the worst types have remained uncultivated. Neither the long, pre-war slump in arable farming nor the war-time boom appreciably affected the utilization of these types. The intermediate types, on the other hand, include those which largely went out of cultivation during the last seventy years and were the first to be ploughed up during the war.

These classes were originally distinguished according to present use, not directly according to soil, climatic or geographical characteristics except in so far as these have determined present use—as in many cases they have to a very large extent. The purpose of the Land Utilization Survey was merely to inventory land use, not to classify land. But as public interest in land planning has grown, a need for a complementary land classification has also become apparent, and has been filled by adapting the land-use inventory. It will be seen from the above descriptions of the classes that they are distinguished not solely on a use basis, but also according to the characteristics of soil and site. There is implied in this classification, as in all others, the outline of a land-use plan—i.e., the classes are distinguished, and the criteria for distinguishing them are selected, with more or less definite uses in view. The plan here postulates the reservation of the most productive lands for agriculture, consequently, the classes are distinguished mainly by agriculturally significant criteria. Stamp [81] suggests :—

(1) that the good agricultural lands, categories 1 to 4 inclusive, which occupy about half of the surface, should be reserved for agricultural use, and that other forms of utilization should only be permitted in exceptional cases, each specific case to be fully justified ;

(2) that schemes requiring extensive tracts of land such as national parks, afforestation, green belts, main highways of parkway type, water-supply and power schemes, should be restricted as far as possible to the poor lands ;

(3) that the integration of national needs in industry, housing, communications, including provision of sites for garden cities and satellite towns should be particularly on land of intermediate quality (5 and 6), since poorer land is only in some areas suitable or available, it being borne in mind at the same time that some of the poorest land is particularly adapted for heavy industry.

For a highly developed country like Britain it is probably impossible to make more detailed recommendations for land use on the basis of a physical and present-use classification, since it is economic rather than physical factors which are often the determinant.

A more detailed ecological classification of grasslands has been made by Stapledon and Davies (cited by [81]) who distinguish the following eleven classes :

(a)	First-grade ryegrass pastures in which perennial ryegrass contributes 30 per cent or more to the sward.	Chiefly lowland types
(b)	Second-grade ryegrass pastures containing 15 to 30 per cent of perennial ryegrass.	
(c)	*Agrostis*-with-ryegrass pastures : being basally *Agrostis*, but perennial ryegrass contributing up to 15 per cent.	
(d)	Ordinary *Agrostis* pastures sometimes containing mere traces of ryegrass.	
(e)	*Agrostis* pastures with excess of rushes and sedges.	
(f)	Fescue pastures, including (i) mountain fescue, (ii) open downland, and (iii) lowland heaths carrying fescue swards.	
(g)	*Nardus* pastures often with excess of heath rush (*Juncus squarrosus*).	Chiefly rough and hill grazing
(h)	*Molinia* pastures.	
(j)	Cotton-grass and deer-grass moors.	
(k)	Heather moor.	
(l)	Fern, gorse and the like.	

Osmond [65] has proposed the use of indices in regional land classification, defined in terms of the three factors site, soil and climate that influence the growth of crops and a fourth—the development factor—which embraces the influences of human activities and of such natural phenomena as are not included in the first three factors.

Each factor in a region is classed as either good (1), intermediate (2), or poor (3). A region is defined by a four-figure index made up of the class figures of the four factors in the order site, soil, climate, development. Thus 1213 indicates that the region has a good site, fairly good soil, good climate, but poor development due, for instance, to past agricultural neglect or to poor drainage. The index shows that if the conditions indicated by the figure 3 can be remedied the area could become of use to agriculture, whereas if the figure 3 had been first in the index (referring to site) improvement might have been precluded in any planning scheme.

The chief site factors considered are elevation, slope and topography ; the chief soil factors are depth, water-holding capacity, nutrient content

and structure ; and the chief climatic factors are rainfall and temperature during the growing season. The indices are given not to soil types or individual farms, but to regions. No definition of a region is given, but presumably the word is used in the modern sense used by geographers.

The indices do not represent a classification, but regions can, if desired, be classified into three categories A, B and C on the basis of the indices—e.g., regions with indices 1111, 1211, 2111 would go into category A, 2221 and 2121 into category B, and 3212 and 3333 into category C.

9. Prussia

A land classification based on the soil survey and used by the Preussische Geologische Landesanstalt is described by Mückenhauser [61] who points out that the ordinary soil map leaves out much information essential to the land planner—for example, the cropping capacity and water economy of the soils. To include such details would make the map too complex for general purposes. Special evaluation maps (*Auswertungskarten*), for the making of which expert knowledge of both soils and the objectives of the land-use plan are necessary, are used to convey the information. In general the planner wants facts about the cropping capacity and water economy of the soils and the nature of the subsoil foundations (*Baugrund*). It has been found convenient in Prussia to express these facts on two special maps, one showing soil utilization and another showing water and subsoil conditions.

The soils are first classified as arable, grassland, forest or wasteland soils, with the recognition that certain grassland soils, for example, could be transferred to the arable class by drainage, etc. The arable and grassland soils are then divided into five and two classes respectively, according to the average yields obtained from them, and these classes are given standard colours on the map. In the legend of the map the commonly grown plants of each soil class are indicated in four separate columns—for grains, inter-tilled crops, fodder and green-manure crops, and trees—and two further columns give a general idea of the cost (*Aufwand*) of maintaining soil fertility, and suitability for settlement.

The various colours for the second map are chosen so that all yellow, red and brown tints indicate land not requiring drainage, grey tints land with impeded drainage, and blue tints land with a water table nearer than 1½ metres to the surface. The corresponding soil-moisture conditions, drainage and irrigation requirements, and subsoil conditions from the building standpoint are indicated in the map legend. Parts of the legend are shown in Tables 7 and 8.

TABLE 7. Legend of soil-utilization maps of the Preussische Geologische Landesanstalt

Colour on map	Soil class according to cropping capacity	Average yield	Appropriate plants				Cost of maintenance	Suitability for settlement
			Grains	Intertilled crops	Fodders and green manures	Trees		
I. ARABLE SOILS								
1. Red	Good arable	24-27 dz./ha. wheat	Wheat, oats, barley, rye	Beet, beans, oil plants	Lucerne, clover, beans	Mixed forest	Moderate liming and manuring	Very good
3. Light brown	Rather poor arable	20-23 dz./ha. rye	Rye, oats, some barley	Potatoes, swedes	Clover, blue lupin, seradella	Mixed forest	Some expenditure on improvements needed	Suitable
5. Yellow	Bad arable	10-13 dz./ha. rye	Rye	Potatoes	Yellow lupins	Pine and birch	Heavy outlay on improvements	Unsuitable
II. GRASSLAND SOILS								
1. Dark blue	Fairly good grassland	40-50 dz./ha. hay	Sundry grasses and legumes			Ash, birch, spruce	Moderate improvement needed	Well suited for grass
2. Light blue	Poor grassland	25-35 dz./ha. hay	,, ,, ,, ,,			Ash, birch, spruce	Greater outlay needed	Suitable
III. FOREST SOILS								
1. Dark green	Good forest					Beech, oak, ash, pine		Unsuitable for settlement, usually owing to steep topography
2. Light green	Poor forest					Pine, birch, hornbeam, (larch, spruce)		

TABLE 8. Legend of the water and subsoil map

Colour	Moisture conditions of soil	(a) Drainage (b) Irrigation	Quality of subsoil for building foundations
Yellow	Dry	(a) Not needed (b) Irrigation profitable	Dry, load-bearing
Light brown	Good	(a) Not needed (b) Not needed	Dry, load-bearing
Light grey	Periodically damp	(a) Very beneficial	Reinforcement of cellar necessary. Load-bearing
Light blue	Damp. Water table 0.8—1.2 m. deep	(a) Necessary	Reinforcement necessary. Load-bearing

Stremme and Ostendorff [87] have attempted to classify land in East Prussia especially, and in Germany generally, according to the area of a holding required to give a minimum standard of living to the occupier. This is in effect a classification according to soil productivity, since the same standard of living is procurable from a smaller area the more productive the soil is. Soils are grouped in genetic classes subdivided into textural classes. The minimum area for existence (*Mindestbetriebsgrösse*) is calculated for each soil class from the gross yield of all crops cultivated on the soil, in two ways. In the first the yield is multiplied by the average price of the produce without reference to the cultivation or cropping system. This gives the average money yield per hectare, from which the area required for minimal existence can be calculated. The classification is simple and said to be applicable without serious modification to the whole of Germany. In the second way a correction is applied to allow for the standard of management practised and attainable.

A further adjustment is made to allow for the different tractive powers required to work soils of different texture. Estimates are based on a peasant family of seven, but allowance has also to be made for the number of horses needed to till the land, which is 4 on heavy soils and 2 on sandy or moor soils. In the Marienburg district of East Prussia, the minimum area varied between 9 and 20 hectares, the smallest (9 ha.) being on a steppe-like brown forest soil, sandy loam overlying loam. This was two-

horse land. The minimum area for a similar, but heavier, four-horse soil was 13.7 ha., and the lowest minimum area for any four-horse land was 12.7 ha.

The number of agricultural holdings into which the whole of East Prussia could be divided on a "minimum-area" basis would be between 234,053 and 161,690 corresponding to minimum areas of 11.2 and 14.3 ha., respectively. The actual number of holdings in 1925 was estimated at 234,228 with an average area of 11.2 ha. The most equable redistribution of the land among the then occupiers would have involved the enlargement of 162,000 and the reduction of 23,000 existing holdings.

10. Land classification for irrigation purposes

The classification of irrigated land or land intended for irrigation presents certain peculiarities since one of the "natural" factors of the environment—moisture—is artificially transformed, and the transformation may profoundly modify another "natural" factor, soil. Moreover, a faulty determination of the suitability of land for irrigation may involve a large and irrecoverable expenditure of money, and cause permanent damage to the soil.

The physical factors which determine suitability for irrigation are climate, soil, relief, drainage and water supply [99]. If any of these is unfavourable, irrigation is likely to be a failure. Geographical, economic and social factors, such as location of the land, extent and distribution of land types, accessibility of water supply, markets and transport, determine whether it is feasible to supply irrigation water to potentially productive land, and what farming systems will succeed. In some areas the character of the population must also be taken into account.

The ideal physical features of an irrigation area are (1) a smooth land surface, (2) a gentle slope sufficient to facilitate irrigation and adequate drainage, and (3) deep, fertile loam soils. The first step in the land-classification system evolved by the U.S. Bureau of Reclamation [62] is to determine whether the location and area of the land which approaches these conditions in the region surveyed justify the execution of an irrigation project. The boundaries of the arable land which can be irrigated with the available water supply are then tentatively determined, and a detailed topographical survey, on a scale of 1 : 4,800, is made, to form the basis for planning the lay-out of irrigation canals, etc. Finally, a soil survey is made in which, in addition to the usual soil characteristics, special attention is paid to salinity or alkalinity, permeability of the underlying rock, and sub-surface drainage.

The actual classification of lands for irrigation purposes is made with particular reference to the three factors soil, topography and drainage. Five or six land classes, designated by numerals and letters to show limiting factors, are distinguished. 1 is the highest, and 6 the lowest, class. The reason for placing land in a lower class than 1 is indicated on the field maps

by placing the letter S (soil), T (topography), D (drainage), or R (loose rock in the arable horizon) after the class number. For example, the symbol 2ST indicates that the land is put in the second class because of inferior soil and rough or steep topography. Further distinctions are sometimes made to indicate low water-holding capacity.

Both deductive and inductive methods are used in the classification. Observations on the success or otherwise of existing irrigation schemes are used in judging what is likely to happen under similar conditions of soil and topography elsewhere. Comparable conditions where the results of irrigation are known are not, however, always to be found. In these cases the soil or land types are evaluated by awarding " points " for the different significant factors. Frequently a combination of deductive and inductive methods is used.

The following are the specifications for the six land classes distinguished by the Bureau of Reclamation [62, 66]. They are generally applicable throughout the western United States.

First-class lands are those constituting the highest type of arable lands, suitable in all respects for cultivation and production of crops by irrigation. They are smooth-lying with slopes up to 5 per cent, soils at least 4 feet in depth, medium or fairly fine in texture, mellow, open structure, allowing easy penetration of roots, air and water, having free drainage yet good water-holding capacity and free from accumulation of soluble salts.

Second-class lands are of intermediate character, suited to the cultivation and production of quite a wide range of crops. They are not so desirable nor of such high value as lands of class 1, because they are more costly to prepare owing to slightly unfavourable topography, more costly to farm because more irrigation water must be used, or because water is difficult to apply. Soils may be comparatively shallow (12–18 inches of good plough soil, 36 inches of soil penetrable by roots and water). Drainage may be impeded and soils may contain moderate concentrations of soluble salts (0.5 per cent or less), and display alkalinity up to pH 9.0 or less in the top 2 feet. Texture of soil may be too sandy or it may be a heavy clay. Topography may be of an uneven or rough slope of less than 5 per cent or smooth slopes of from 5 to 10 per cent.

Third-class lands are of inferior or low quality and poor productivity. They have a restricted crop adaptation owing to such soil deficiencies as shallow depth (6 to 12 inches over gravel and loose rock, 36 inches penetrable by roots and water) ; extremes of texture (sandy or heavy clay) ; or presence of sufficient loose rock on the surface and in the plough zone seriously to interfere with cultivation. In some instances they are lands having impeded drainage and moderate concentrations of soluble salts. In some areas they are lands of uneven topography where erosion might occur.

Fourth-class lands are those which sometimes have a specific limited utility. They are made up of heavy compact soils with tough impervious layers in the subsoil. Sometimes they can be artificially drained. For the most part these lands are considered as non-arable.

Fifth-class lands are sub-marginal. They often include lands which are waterlogged and have an accumulation of an injurious amount of soluble salt, or lands which are subject to correction only through construction of flood-control or drainage works.

Sixth-class lands are permanently non-arable, consisting of lands which have a rough, broken or eroded surface, rendering them unfit for cultivation. Other areas consist of rough regions of raw shale, or shallow soils over shale and sandstone. Here also are included lands which are too high for delivery of irrigation water in this class.

Besides the detailed surveys, reconnaissance surveys on a scale of 1 : 24,000 are made to determine the general extent and location of cultivable areas, or for use on areas under consideration for supplemental water supply, and semi-detailed surveys (scale 1 : 12,000) the results of which are used in conjunction with engineering investigations to determine the feasibility of projects, or the extent and character of lands utilized within a given drainage area [62].

Page [66] states that the purpose of the land-classification work of the Bureau of Reclamation is to determine exactly where and in what quantities irrigable lands can be found for subdivision into tracts of sufficient size and productive capacity to support single families and to repay irrigation costs. The economic aspect of land classification is therefore important. The determination of costs is mainly an engineering problem, but the determination of potential earning power after irrigation has been installed is a problem of land classification, as earning power depends on type and yield of crops that can be produced, besides market requirements, transport facilities, etc. Experience in the United States has been that the stability and economic security of an irrigation settlement depend on charges for water being based on the quality of the land rather than entirely on the quantity and cost of delivery of water supplied, since the same quantity of water will give different returns on different qualities of land, and if charged at the same rate would make one farm unit economically feasible, and another unfeasible [62]. Hence, " paying classes " are distinguished, consisting of land types each of which can be subdivided into economic farm units of approximately equal size, ranging from 40 to 80, and not exceeding 160 acres.

Blanch and Stewart [9] describe a scheme of classification for a region already extensively irrigated (the Uinta Basin, Utah) with a view to securing the best distribution of the available water and the best utilization of the irrigable land. The classification starts from the premise that society profits more when the available water is used on the best lands.

Two classifications are presented : (1) a present-use classification, and (2) a desirable-use classification. The first shows the apparent need for adjustment of water to land, based on present (1943) conditions, the second shows what would be the most desirable combination of land and water over an extended period of time, as indicated by analysis of all available information. In the present-use classification three sets of factors were taken into consideration, namely :

Soil factors : alkali, drainage, topography, slope, erosion.

Irrigation-water factor : quantity of water received, and distribution throughout the growing season.

Location of land : with respect to community institutions and source of water supply.

Other factors such as climate and transport facilities were taken as uniform over the area surveyed.

The area was divided into 130 sub-areas, usually of not less than 300 acres and uniform with respect to the three factors listed above. The sub-areas were then classified as (A) satisfactory soil and water conditions, (B) adjustments in soil and water use desirable, (C) adjustments imperative, (D) land mostly not irrigated, but good enough to irrigate.

In the desirable-use classification the same factors were considered as in the present-use classification. Since water is the only factor that lends itself to redistribution the problem was one of determining how the available water could be most effectively used. The available supply is not adequate for all the irrigated land, but it is adequate to irrigate the most productive soils. Hence the sub-areas were regrouped on the assumption that each received a full water supply. Three desirable-use classes (out of the nine in a system applicable to all rural land in Utah) were distinguished, namely, class II range or pasture, class V extensive arable, and class VI more intensive arable.

Comparison of these two classifications is said to have given clear and precise information about the most desirable adjustments to be made in the irrigation of the region and the economic feasibility of the adjustments.

A system of classification for irrigable lands in South Africa was described in Technical Communication No. 15 [40]. " Irrigable-value " soil maps are made on a scale of 1 : 6,000, using detailed topographical maps, when available, as base maps. Soil profiles on representative sites are studied and classified into four grades of " permeability profile ", as follows :—

I. An eight-foot depth of soil free from undesirable layers such as hardpan, dense clay, coarse sand, etc.

II. At least four feet of soil of grade I resting on soil containing interfering layers, or on semi-permeable hardpan or clay, very open sand, etc.

III. At least four feet of soil of grade I resting on *solid* rock or other impenetrable formations, or 30 inches of soil of grade I resting on semi-permeable or gravelly layers.

IV. Shallow soils which do not conform to the above grading, such as less than four feet of soil on impenetrable rock, or less than 30 inches of soil on semi-impenetrable or markedly interfering layers.

The soils are also classified according to the average salt content of the profile (so-called brak) :—

Grade I. Soils showing an average salt content (deduced from electrical-resistance figures and checked by actual analysis of the water extract of the soil type) of less than 0.15 per cent.

II. Average salt content from 0.16 to 0.35 per cent.

III. ,, ,, ,, ,, 0.36 to 0.55 ,, ,,

IV. ,, ,, ,, over 0.55 per cent.

These two factors are combined to deduce the final irrigable value thus :—

	Profile	*Salt*	*Irrigability*
Grade	I	I	I
	II	I	II
	I	II	
	II	II	III
	III	I	
	I	III	
	other combinations		IV

The grading may further be influenced by such factors as development of soils and agricultural experience, site of concentration and nature of brak salts, abnormal pH values, general topography, etc., but these are usually only applied in doubtful cases, their main use being in connexion with the giving of advice to farmers.

The Estimation of Productivity

The simplest land classification to understand—and simplicity is an important virtue in the execution of a land-use plan—is one in which classes are distinguished by numbers expressing some significant land property, particularly productivity. In some examples already given, land classes are distinguished as Class I, II, III and so on, but there is nothing to indicate how much better or worse Class I is than Class II. The numbers are merely expressions of the classifier's judgment. Many attempts have been made to arrive at a more objective and quantitative estimate of productivity. The methods used may be classed generally as inductive (e.g., by adding or otherwise integrating "marks" awarded to certain properties of the land or soil that influence productivity) or deductive (e.g., deduced from yield data), but many methods in actual use are a combination of both types.

It is important to appreciate what is meant by productivity. It is the capacity of a soil to produce crops in general, or one specific kind of crop, and is the resultant of the qualities of the so-called natural factors of the environment—especially soil, climate and topography—*plus* human

labour or " management ". The productivity of any untouched soil for cultivated crops is nil ; it is possible to speak of the productivity of natural grass and forest land, but even here labour must be expended before the produce can be used. The relative importance of " management " in the total productivity may be almost negligible in an open range, and predominant over that of all other factors in irrigated agriculture. As already stated productivity is a partly economic concept, and can only partly be expressed in terms of the inherent characteristics of land. " Every time one says that a certain piece of land is productive . . . there is implied in that statement a prediction of agricultural prices and management costs just as much as if they had been stated in dollars and cents " [45].

Productivity ratings

In recent years there have been included in the county soil-survey reports of the U.S. Department of Agriculture tables showing the " productivity ratings " of all the soil types of the areas surveyed. The productivity rating is " the crystallized expression of the experience of the people who have used or are using the land " [1]. Ratings are given to specific soil types as defined by the U.S. Soil Survey. In the soil-survey reports tables are given of productivity ratings or indices in relation to all the main crops of the district, e.g.,

Soil type	Corn		Wheat		Rye		Alfalfa		Sugar beet		Productivity grade	
	A	B	A	B	A	B	A	B	A	B	A	B
Miami loam	70	90	70	100	80	100	70	90	60	70	3	1

The figures under A and B refer respectively to the percentage of the standard yield of the crop obtainable with (A) common practices of management (average farming) in the area, and (B) the best current practices. The standard yields are selected " to represent the approximate average yield obtained for that crop on the more extensive and widely developed soils of the regions in the United States in which the crop is a principal product "[1]. The standards refer to average yields obtained without the use of amendments, although it has been arbitrarily agreed that nitrogen fixed by legumes and manure produced from feed grown on the land are not to be considered as amendments. E.g., the standard for corn is 50, and for wheat 25, bushels per acre ; for clover and timothy it is 2, for alfalfa 4, tons. Under average management for the county in question the Miami loam will yield 35 bushels of corn and 17½ bushels of wheat, and under first-rate management 45 bushels of corn and 25 bushels of wheat. The difference between the (A) and (B) ratings is a measure of the soil's response to good management.

The " productivity grade " indicates the soil's general productivity for the common crops of the region, and is obtained by a simple percentage weighting of the crop ratings according to each crop's importance in local agriculture. Soils with a weighted average between 100 and 90 are graded 1, between 90 and 80, 2, and so on. Those with low A and high B productivity

grades would be described as low in fertility (plant-nutrient content), but productive (responsive to management). Productivity grading is admitted to be a somewhat arbitrary procedure, depending, as it does, on the validity of the system of weighting. From the example given above it would appear that the Miami loam is used predominantly for cereal growing since its productivity grade corresponds to its productivity ratings with respect to cereals.

Formerly the " inherent " productivity based on the qualities of the soil and environment, and the " actual " productivity based on crop yields obtained under an average level of management, were estimated, but the inherent productivity has now been discarded on the grounds that few soils have any agricultural productivity at all without at least some management, and its place has been taken by the " potential " productivity, which is that obtainable by the best management. The inherent productivity has to be obtained inductively, since there are no yield data for " unmanaged " soils, and there is no true connexion between this and the deductively obtained actual productivity. Calculation of the ratings is based entirely on agricultural experience as indicated by crop yields. Study of the soil is required only to identify soil or land types. The yield figures from which the ratings are determined are estimated from data obtained by the soil surveyor from interviews with farmers and county officials, AAA records, elevator records, personal observations, etc. The chief difficulty in determining ratings from yield data is to establish a standard of management and to estimate the degree of divergence from the standard on each farm. The usual standard of management is defined as that which will maintain soil productivity at or near the level of the " nearly virgin " soil. It is important to note that productivity ratings are not convertible to crop yields except under certain definite conditions. The ratings are meaningless unless a physical definition is given of the system of management assumed. At present sufficient data are not available of yields obtained under standard or comparable systems of management to give the ratings a fixed character. Nevertheless, " provided the soil types and phases are properly defined, the concept of the productivity rating makes available a means for synthesizing the great background of research work and experience in one figure of expected yield under a defined system of management " [45].

Tyler [91] maintains that productivity ratings, if they are to be used for agricultural land classification, should be based to a greater extent than hitherto on actual yields obtained over a period of years. A difficulty here is that many, if not most, fields, which are the units for yield measurements, contain more than one soil type. Another difficulty is that in areas where the use of soil amendments is common, accurate data of yields obtained without amendments are not usually obtainable.

The Storie index

An inductive method of rating the agricultural value of soils has been suggested by Storie [84]. Regardless of actual cropping experience with

the soils Storie compiles the ratings from percentage values accorded to certain characteristics of the soil profile. Three " factors " are used, one referring to the general character (excluding texture) of the profile and particularly to the stratification and degree of weathering, one referring to the surface texture, and a third to " soil-modifying conditions " such as drainage, acidity and alkalinity, erosion, etc. The values of these three factors expressed as percentages of the optimal conditions for plant growth are multiplied together to obtain the rating, and the product is expressed as a percentage of the maximum. The advantage of multiplying instead of, as is more usual, adding the points credited to each soil characteristic is that thereby any one abnormal factor can dominate the final rating. Thus a soil may have excellent profile conditions rated at 100 for the first factor, excellent texture rated at 100 for the second factor, but bad alkali accumulation rated at 10 for the third factor. The product of the three gives a percentage rating for the soil of 10, according with the fact that despite other favourable conditions the alkali renders the soil unproductive. On an addition basis the rating would have worked out at 70 per cent.

Canadian rating systems

Saskatchewan. Mitchell [58], who points out that the rating system must be adapted to the type of agriculture practised, has used in Saskatchewan a system similar to Storie's and designed to indicate a soil's ability to produce grain. He used three factors : (A) soil profile (texture 40, structure 30, natural fertility 30 ; maximum 100 points) ; (B) topography (maximum 100, minimum 10 points, according to slope conditions) ; (C) climate 25, salinity* 25, stoniness* 25, tendency to drift* 25 ; maximum 100. The productivity index is obtained by adding the component marks of each factor, multiplying the total marks for the three factors, and expressing as a percentage. It is provisionally suggested that an index of 30 is the margin for arable land.

The index is being used in an assessment of rural municipalities as the basis of a " natural " land classification. Superimposed on this is a " practical " classification which takes into account factors such as freight costs, distance from markets, etc.

Alberta. The Alberta Soil Survey prepares land-class maps to accompany the soil maps [10]. The land-class map interprets the physical data of the soil map in terms of productive capacity. Economic factors are not considered, although it is recognized that certain factors such as price have influenced the kind of crops grown in the past, the yield records of which are used as a measure of probable productivity. Eight land classes are distinguished—three pasture (the poorest), one marginal arable, and four arable (the best).

The soil type on the soil map is distinguished by a 3-digit number referring to the soil-colour zone (reflecting rainfall and fertility), the mode

* Full marks for none, and deduct proportionally.

of deposition of the parent material and the nature of the soil profile, i.e.—*First (or hundreds) digit*: brown soils 1; dark brown soils 2; shallow, or southern black 3; black 4.

Second (or tens) digit: residual 0; sorted residual 1; glacial, unsorted and variable 2; resorted or uniform glacial 3; gravelly outwash 4; alluvial 5; alluvial or aeolian 6; aeolian or lacustrine 7.

Third (or units) digit: 0–7, distinguished according to profile characteristics, among which salinity is specially noted.

To determine the land classes these digits are given percentage ratings, and other ratings are given for texture, topography, erosion, stoniness, alkali, and any other local factor affecting productivity. The ratings are multiplied together and expressed as a percentage of the total possible, e.g.—

Characteristic	*Description*	*Rating*
Colour	brown to dark brown	50
Deposition	glacial	80
Profile	normal	100
Texture	light loam	70
Alkali	absent	100
Stones	numerous	60
Topography	very hilly	40

Multiplied together, these give a percentage rating of 6.7, placing the land in Class 2 (Class 8 is best)—fair to good pasture. The method represents "an effort to meet present-day requirements by taking an inventory of soil resources and interpreting the data in terms of a probable productivity classification. This information should be of material aid in any programme of land-use planning."

Ranking coefficients

Kendall [47] proposed a rather different method of rating the relative productivities of English counties. He took the county as land unit, since he was using the official yield figures of the Ministry of Agriculture, and these are compiled on a county basis. The county has obvious disadvantages as a unit since its boundaries have no relationship to those of geographically, economically or agriculturally determined areas. Kendall developed four different measures of productivity, using available statistics of the ten major crops—wheat, barley, oats, beans, peas, potatoes, turnips and swedes, mangolds, hay from temporary grass and hay from permanent grass.

(1) *The productivity coefficient.* This coefficient was obtained by regarding the average yields as the coordinates of a point in 10-dimensional space. From the counties of England 48 points were obtained, and the line which fitted these points best (the sum of squares of the perpendicular distances of the 48 points from the line being a minimum) was used to rank the

counties. This coefficient involves very intricate calculations, and does not seem to have any advantage over the other three more simply determined coefficients.

(2) *The ranking coefficient.* Each county was ranked for the average yield of each of the ten crops, and the coefficient of each county was the mean of these rankings. Counties with high yields had low ranking coefficients, and *vice versa.*

(3) *The money-value coefficient.* Obtained from the average value produced per acre from the ten crops.

(4) *The energy coefficient.* The average gross digestible energy produced per acre.

Neither the productivity coefficient nor the ranking coefficient takes any account of the area devoted to each crop in the counties. As there are obviously large differences between counties in this respect, the use of equal weights for all crops gives an unfair comparison between counties, particularly as the correlations of the yields of grass and fodder crops with those of cereal crops are often negative. The money-valued coefficient has some advantages over the two previous ones—for example, account is taken of the volume of production. One disadvantage is that certain parts of the country are better suited for the more profitable crops—because of proximity to markets—and the coefficient will tend to measure this factor. Kendall's last coefficient—the energy coefficient—has more to recommend it, but it is unfortunate that he chose to work in terms of gross digestible energy. This has the effect of favouring the wheat-growing counties, since about half of the energy value attributed to wheat is due to straw of which most of the nutritive value is available for fuel purposes only. Moreover, pasture which is hayed is only assessed with respect to the hay produced, and as hay is of the order of half the total output for the year counties with a large amount of hay have low coefficients. This is probably the reason for the differences in the grading of Somersetshire, for example, which was given a high grade by the productivity and rank methods, but a low grade by the others.

On the basis of the four coefficients for each of four years, Kendall classified the counties as excellent, good, moderate, indifferent or poor. This was done for each of the four years 1925, 1930, 1935 and 1936. On the whole, counties with good reputations for productivity came out consistently high in the ranking list, and those with poor reputations consistently low. Intermediate counties fluctuated rather widely from year to year, and from coefficient to coefficient. Kendall was estimating actual rather than potential productivity [24]. Actual productivity will obviously vary from year to year according to weather, price level and other external influences.

German soil ratings—*Bodenbonitierung*

Much work has been carried out in Germany on the quantitative assessment of soil quality. After the first world war a general reassessment

of taxable land values was necessary and had to be carried through rapidly. Several schemes for rating agricultural land were proposed, a common feature of all being that productivity deriving from skill in management was not taken into consideration. It was thought that a man should not be penalized by higher taxes for improving his land. Assessments were based on the yield capacity determined by the natural conditions of soil, climate, topography and water, and the local conditions of farm economy, especially market and labour conditions, as well as the nature of the holding (compact, scattered, distance of farmhouse from the fields, etc.). These were almost the identical bases on which A. von Thaer, the father of German *Bodenbonitierung*, had constructed his first land-valuation tables in the early years of the nineteenth century [90].

The general procedure in Germany was to classify the land of an estate firstly as arable, pasture, meadow or forest land, and then make further separate classifications inside each class. The classifications are based entirely on the properties of the soils. The influence of economic and commercial factors and of factors such as size, lay-out and nature of the farm is assessed quite separately, and then superimposed on the soil classification, usually by allotting a certain percentage of possible points to internal or soil factors and a certain percentage to external factors. Assessment of arable land is made mainly inductively, from the properties of the soil, and of grass and forest land deductively, from yield data.

In order to secure a uniform standard of rating, a " national standard estate " (*Reichspitzenbetrieb*), that of Frau Else Haberhauffe, Eickendorf, near Magdeburg, was given a rating of 100. Local standard estates in different parts of Germany were rated relatively to the national standard, and in this way a series of suitably located standards was set up to which all ratings could be referred [74].

Schattenfroh [74] states that the allotment of " points " for the separate conditions must by its very nature be so subjective that the points can only be regarded as a rough guide. Only experience can teach the assessor his job. The natural and economic factors are quite independent. Relative prices or rentals of land give good indications of the effect on productivity of variable natural conditions under similar economic conditions, or of variable economic under similar natural conditions. The usefulness of a system of land assessment based on awarding points for various factors in productivity depends on the correct judgment of the relative points values to be allotted to the totality of natural and economic factors, respectively.

According to Schattenfroh the points value of the economic factors should ordinarily be about 60 per cent of that of the natural factors for flat agricultural land. This, presumably, refers specifically to German conditions in the inter-war period. Near large cities and industrial centres the relative value of economic factors rises and may exceed that of natural factors. In the open market, however, economic and particularly commer-

cial factors exert a much greater influence on the price actually paid for land than do the intrinsic qualities of the soil.

Several points systems are cited by Schattenfroh. In Fackler's Bavarian system [20] points are awarded as follows :—

For soil conditions	up to 30 points
,, climate	,, ,, 20 ,,
,, other natural factors	,, ,, 60 ,,
,, economic factors	,, ,, 10 ,,
Total	120

Soil condition is determined mainly by texture and humus content (highest is humous loess—*Schwarzerde*) with marks added or subtracted according to the depth of the arable horizon, the nature of the subsoil and the general cultural condition. Economic factors appear to be confined to the distance of the farm from the nearest railway station or town.

Bömer [74] allots points for Westphalian farms as follows :—

Nature of arable layer	20	
Depth of arable layer	10	
Groundwater conditions	10	
Surface topography	8	
Total for soil factors		48
Climate (temperature and rainfall)	18	18
Marketing conditions	17	
Type and state of culture	7	
Distance of fields from farmstead	5	
Labour conditions	5	
Total for economic factors		34
		100

Thus whereas Fackler estimates soil influences at 25 per cent and economic influences at less than 8 per cent, Bömer estimates the former at nearly 50 per cent and the latter at 34 per cent.

Rothkegel and Herzog [71] worked out a system which was accepted in 1928 by the German Treasury for the valuation of agricultural estates. Different scales of valuation are used for arable and grassland. For arable land, eight soil groups are distinguished with points values varying from 100 (loamy chernozem) to 6 (coarse sand, pure clay, high moor). Pastures are marked directly according to the length of the grazing season and the carrying capacity.

For meadows the scale is based on the quantity and quality of the natural meadow plants, and hence on the quantity and quality of the harvest. Points values vary from 100 (corresponding to an attainable harvest of 75 double centners of good hay per hectare) to 12 (corresponding to 20 dz./ha. of poor but eatable hay).

Besides the soil characteristics in arable land, and the yield and ecological characteristics in grassland, an apparently rather arbitrary and subjective estimation is made in Rothkegel and Herzog's system of the actual and potential effects on productivity of climate, exposition, possibilities of drainage and irrigation, and cultural condition of the soil. In the assessment of economic factors special attention is paid to means of transport and communication.

Criticizing this system Schattenfroh states that it represents an attempt to establish a scientific basis for tax assessment, but that it is much too complicated for ordinary practice, and could not be operated except by highly trained assessors. The range of marking for soil quality, from 100 to 6, is, moreover, too wide and leaves too much to the assessor's personal judgment. In group I (mild loams) the range is 22 points, and in group VI (heavy clays) it is 50 points. Similar ranges occur in the grouping of pastures and meadows. Consideration of the subsoil, also, is left largely to the assessor's discretion.

Schattenfroh himself devised a scheme (modified from an earlier one of Weisslein) for Bavaria, in which soils were first grouped into four classes according to texture—heavy soils (marked 0–8), loams (marked 9–12), light soils (marked 1–8) and humus soils (marked 0–10). The depth of arable soil is ignored, because this depends more on the means of cultivation at the disposal of the farmer than on inherent soil properties, and few farmers in Bavaria could afford to cultivate deeply and thus to take advantage of a potentially deep soil. The humus content is evaluated as a percentage addition to the points mark, e.g., 10–20 per cent addition for a 5 per cent humus content, and 30–50 per cent addition for 15–20 per cent of humus. Acid soils get a percentage deduction, and calcareous soils a percentage addition. The deduction for acidity is greater in regions devoted predominantly to acid-sensitive crops (wheat, barley, sugar beet, clover) than in rye, oats and meadow regions. A percentage deduction for stoniness is made according to the quantity of stones and the soil texture. Other additions or deductions are made for climate (according to quantity and distribution of rainfall and the length of the local compared with the regional frost-free period), for compactness of the holding and distance from a market. Extensive tests of the system in practice, however, indicated that the relative importance and quantitative assessment of humus content, acidity, lime status, stoniness, groundwater relationships, etc., varied greatly from place to place.

The number of other German points systems for soil evaluation that have been proposed is legion [33]. Van Aartsen [93] has described several not mentioned here, and has compared the German systems as a whole with the American productivity ratings.

Görz [25] states that there is now no dispute that the soil must be the starting point of any modern system of agricultural land evaluation, but that some authorities favour the *Bodentyp* (genetic soil type) whilst others favour the *Bodenart* (textural soil variety) as the basis of the classification.

From the important practical standpoint of getting the man-in-the-field to understand what is being done, there is much to be said for using the soil variety, and all the numerous German systems for the points evaluation of land lay particular weight on soil texture. Görz, however, points out that a classification based solely on soil-variety distinctions is only valid so long as a certain extensity of utilization allows differences in value between different soil varieties to be clear. As land utilization becomes more intensive these differences tend to lose their significance, while that of soil-type differences increases relatively. A practical soil evaluation must take into consideration and combine both practical experience and the scientific premises of the valuation system in a form which is immediately comprehensible to the practical man. For the same reason, information about land quality obtained from practical experience and the "feel" of the soil (*Fingerspitzgefühl*) should be expressed in a simple quantitative form.

These practical requirements are best satisfied by means of a points system. According to Görz, points are allotted in the standard *Bonitierungssystem* for texture (varying from loam 10.0–8.8 to sand 4.1–2.0) and for soil condition or type, marked from 10 (mild loess) to 4 (podzol with ortstein). The rating is obtained by multiplying the texture marks by the type marks. Thus at one end of the scale a loess loam gets 100 points, and at the other end a sandy heath podzol gets 8 points.

Points values for soil types and varieties are obtained from the gross and net yields obtained from large numbers of different soils accurately described and classified by experienced assessors.

Herzog [31] gives more factual details about how the official system of soil assessment had developed by 1939. In 1939 there were 2,000 soil assessors in the Reich besides numerous other workers indirectly engaged. The purpose of the assessment was to form a basis for taxation, but as the work proceeded the possibilities of using it for advisory purposes and for land-use planning came increasingly into the foreground. The intention was that every quarter hectare should be sampled (and even smaller areas where the soils were very variable), the soil conditions described and a map prepared.

The assessment is arrived at by giving a soil marks according to certain characteristics, but the marks appear to be given for the combined characteristics as a whole, not for each one separately. Different characteristics are used for arable land and grassland, respectively.

Arable soils are first classified into 8 textural varieties (*Bodenarten*: S=sand, Sl=slightly loamy sand, lS=loamy sand, SL=very loamy sand, sL=sandy loam, L=loam, LT=heavy loam, T=clay), and moor (Mo). The second differentiating characteristic is the origin : Lö=loess, D=diluvium, Al=alluvium, V=non-transported weathered material. The suffix g attached to V (Vg) indicates very coarse or stony material. A third differentiation is made according to the condition (*Zustandsstufe*) or stage of development of the soil. The most immature soils represent stage 7, fully mature soils stage 1, at which the productivity of the soil is, other things being

equal, greatest. Many soils never reach stage 1, owing to peculiarities in local conditions, such as topography, rainfall and groundwater relationships, others revert by processes of degradation from stage 1 to less productive stages. It is not clear how the stage of development is determined.

For grassland soils only four *Bodenarten** (S, lS, L, T—also Mo) are distinguished and three *Zustandsstufen*. The origin of the soil is not taken into consideration, but marks are given according to mean annual temperature (three classes a, b and c) indicating the length of the growing season, and moisture relationships (five classes).

The description and rating of a soil profile are given in symbols, e.g.—

$$\frac{\text{h–}\bar{\text{h}}\ \text{mi fs L 2.5–3}}{\text{h}'\ \text{mi fs L 3}} \qquad \text{L 2 Lö 83}$$

$$\overline{\text{ka}}\ \text{fs L}$$

According to the symbols on the right, this is a loam derived from loess, *Zustandsstufe* 2, rating 83 (relative to the best agricultural soil in Germany, rating 100). The symbols on the left describe the horizons of the profile in more detail. The top horizon is a medium to highly humous (h–$\bar{\text{h}}$) mild (mi) fine sandy (fs) loam (L), underlain by a weakly humous (h′) mild fine sandy loam, underlain again by a strongly calcareous ($\overline{\text{ka}}$) fine sandy loam. No indication is given in Herzog's paper as to the meaning of the figures following the symbol L in the profile description ; they do not seem to refer to the same *Zustandsstufe* indicated in the symbols on the right.

A profile description of a grassland soil is as follows :—

$$\frac{\text{zer gt Hmo 1–2}}{\text{r u. to Hmo}} \qquad \text{Mo II a 3—31}$$

i.e., a well (gt) decomposed (zer) highmoor (Hmo) overlying a raw (r) and (u.) peaty (to) highmoor. For rating purposes the soil is a moor (Mo), *Zustandsstufe* II, climate a (= mean annual temperature 8°C. or over) moisture condition 3, rating 31.

The profile descriptions can be very varied. There are 46 symbols referring to soil characteristics, 9 to water relationships, 18 to types of cultivation and other peculiarities, and about a dozen "other abbreviations". The ratings are calculated from Tables 9 and 10.

The ratings have no absolute significance, being merely relative numbers expressing differences in gross yields which can be obtained under ordinary, average management. In estimating the ratings, moderate climatic conditions—8°C. mean annual temperature and 600 mm. rainfall—level or gently sloping topography, and market conditions corresponding to those in central Saxony are assumed.

It has been proposed, however, to use the ratings to put a cash value on soil for taxation purposes. It is argued [70] that the productivity of land is the result of a combination of the factors soil, capital and labour, but it is impossible to determine what part of the yield of a field is attributable

* Gericke [23] showed from a statistical analysis of more than 2,000 experiments that soil texture had practically no effect on hay yields.

to soil productivity, and what parts to machinery, buildings, stock, labour, and so on. Although the value of the " bare soil " of a field or of a soil type cannot therefore be estimated from the results of farming, that of the soil of a complete farm can be. The soil of the farm is given a percentage productivity rating relative to the best soil (100 per cent) in Germany. The land is capitalized on a basis of 4 per cent of the net profit, which is 210 RM. per ha. for soil with rating 100—i.e., 5250 RM. per ha. (in 1944).* Land rated at 20 would thus have a capital value of 1050 RM. The capital value of the buildings and the living and dead equipment of the farm is calculated and divided by the number of hectares in the farm. This is subtracted from the capital value of the land per hectare determined from the net profit (*Reinertrag*), giving the value of the soil. E.g., land rated at 20 might have a value of 490 RM. per ha. for buildings, 300 RM. for stock, and 140 RM. for other equipment, total 930 RM., leaving 120 RM. for the value of the soil. Land rated at 100 might have a value of 1450 RM. per ha. for buildings, 500 RM. for stock, and 300 RM. for other equipment, leaving 3000 RM. for the value of the soil (total 5250 RM.). It is claimed that this method of soil assessment provides a sound basis for calculating land taxation.

* In 1929 the capital value of 100-rating land was 4140 RM. per ha. [74].

TABLE 9. Arable-land rating (German system)

Soil variety	Origin	Stage of development						
		1	2	3	4	5	6	7
S	D		41–34	33–27	26–21	20–16	15–12	11– 7
	Al		44–37	36–30	29–24	23–19	18–14	13– 9
Sl (S/lS)	D		51–43	42–35	34–28	27–22	21–17	16–11
	Al		53–46	45–38	37–31	30–24	23–19	18–13
	V			42–36	35–29	28–23	22–18	17–12
lS	D		59–51	50–44	43–37	36–30	29–23	22–16
	Lö		62–54	53–46	45–39	38–32	31–25	24–18
	Al		62–54	53–46	45–39	38–32	31–25	24–18
	V			50–44	43–37	36–30	29–24	23–17
	Vg							
SL (lS/sL)	D		67–60	59–52	51–45	44–38	37–31	30–23
	Lö		72–64	63–55	54–47	46–40	39–33	32–25
	Al		71–63	62–55	54–47	46–40	39–33	32–25
	V		67–60	59–52	51–44	43–37	36–30	29–22
	Vg				47–40	39–32	31–24	23–16
sL	D	84–76	75–68	67–60	59–53	52–46	45–39	38–30
	Lö	92–83	82–74	73–65	64–56	55–48	47–41	40–32
	Al	90–81	80–72	71–64	63–56	55–48	47–41	40–32
	V		76–68	67–59	58–51	50–44	43–36	35–27
	Vg				54–45	44–36	35–27	26–18
L	D	90–82	81–74	73–66	65–58	57–50	49–43	42–34
	Lö	100–92	91–83	82–74	73–65	64–56	55–46	45–36
	Al	100–90	89–80	79–71	70–62	61–54	53–45	44–35
	V		82–74	73–65	64–56	55–47	46–39	38–30
	Vg				60–51	50–41	40–30	29–19
LT	D		78–70	69–62	61–54	53–46	45–38	37–28
	Al		82–74	73–65	64–57	56–49	48–40	39–29
	V		78–70	69–61	60–52	51–43	42–34	33–24
	Vg				57–48	47–38	37–28	27–17
T	D			63–56	55–48	47–40	39–30	29–18
	Al		74–66	65–58	57–50	49–41	40–31	30–18
	V			62–54	53–45	44–36	35–26	25–14
	Vg				50–42	41–33	32–24	23–14
Mo				45–37	36–29	28–22	21–16	15–10

TABLE 10. Grassland rating (German system)

Soil variety	Stage	Climate	Moisture conditions 1	2	3	4	5
S	I (45–40)	a	60–51	50–43	42–35	34–28	27–20
		b	52–44	43–36	35–29	28–23	22–16
		c	45–38	37–30	29–24	23–19	18–13
	II (30–25)	a	50–43	42–36	35–29	28–23	22–16
		b	43–37	36–30	29–24	23–19	18–13
		c	37–32	31–26	25–21	20–16	15–10
	III (20–15)	a	41–34	33–28	27–23	22–18	17–12
		b	36–30	29–24	23–19	18–15	14–10
		c	31–26	25–21	20–16	15–12	11– 7
lS	I (60–55)	a	73–64	63–54	53–45	44–37	36–28
		b	65–56	55–47	46–39	38–31	30–23
		c	57–49	48–41	40–34	33–27	26–19
	II (45–40)	a	62–54	53–45	44–37	36–30	29–22
		b	55–47	46–39	38–32	31–26	25–19
		c	48–41	40–34	33–28	27–23	22–16
	III (30–25)	a	52–45	44–37	36–30	29–24	23–17
		b	46–39	38–32	31–26	25–21	20–14
		c	40–34	33–28	27–23	22–18	17–11
L	I (75–70)	a	88–77	76–66	65–55	54–44	43–33
		b	80–70	69–59	58–49	48–40	39–30
		c	70–61	60–52	51–43	42–35	34–26
	II (60–55)	a	75–65	64–55	54–46	45–38	37–28
		b	68–59	58–50	49–41	40–33	32–24
		c	60–52	51–44	43–36	35–29	28–20
	III (45–40)	a	64–55	54–46	48–38	37–30	29–22
		b	58–50	49–42	41–34	33–27	26–18
		c	51–44	43–37	36–30	29–23	22–14
T	I (70–65)	a	88–77	76–66	65–55	54–44	43–33
		b	80–70	69–59	58–48	47–39	38–28
		c	70–61	60–52	51–43	42–34	33–23
	II (55–50)	a	74–64	63–54	53–45	44–36	35–26
		b	66–57	56–48	47–39	38–30	29–21
		c	57–49	48–41	40–33	32–25	24–17
	III (40–35)	a	61–52	51–43	42–35	34–28	27–20
		b	54–46	45–38	37–31	30–24	23–16
		c	46–39	38–32	31–25	24–19	18–12
Mo	I (45–40)	a	60–51	50–42	41–34	33–27	26–19
		b	57–49	48–40	39–32	31–25	24–17
		c	54–46	45–38	37–30	29–23	22–15
	II (30–25)	a	53–45	44–37	36–30	29–23	22–16
		b	50–43	42–35	34–28	27–21	20–14
		c	47–40	39–33	32–26	25–19	18–12
	III (20–15)	a	45–38	37–31	30–25	24–19	18–13
		b	41–35	34–28	27–22	21–16	15–10
		c	37–31	30–25	24–19	18–13	12– 7

Climate a = over 8.0°C. mean annual temperature
b = 7.9—7.0°C. ,, ,, ,,
c = 6.9—5.7°C. ,, ,, ,,

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APPENDIX

Outline of a U.S. Soil-Survey Report

(Reproduced from [44])

In order to achieve some uniformity in the treatment and arrangement of subject matter in the report, especially for the convenience of those using large numbers of these reports, the outline which follows has been prepared. This outline cannot be followed blindly, as each area has its own particular features and problems requiring emphasis, and certain sections, given only broad headings, must be carefully organized in subdivisions.

General Arrangement of Material in the Soil-Survey Report

1. Description of the area surveyed.
    - (A) Location and extent of the area.
        - (1) General location within the State or Territory.
        - (2) Distance of county seat or principal town from one or more important places.
        - (3) Size of area in square miles.
    - (B) Physiography.
        - (1) Mention of the physiographic division of the United States in which the area is located.
        - (2) General description of the physiography and geology of the area.
    - (C) Relief.
        - (1) Discussion of any modification of the physiographic surface by natural dissection.
        - (2) Sketch map of relief areas if such a sketch is of material assistance to the discussion.
    - (D) Elevation.
        - (1) General elevation of the area and ranges in elevation.
        - (2) Altitude of some of the main topographic features.
        - (3) Altitude of towns or other known points. (Cite authority for data.)
    - (E) Vegetation.
        - (1) General but brief discussion of the vegetation, including especially the original and present forests, grasses, or shrubs. (Ordinarily there should be no detailed description of species unless this is important where many comparatively uncommon plants are mentioned. The common names should be used, but a glossary of botanical names should be given, especially where noncrop plants need to be discussed at length.)

(F) Organization and population of the county.
  (1) Date of settlement.
  (2) Important historical data.
  (3) Source and distribution of the population.
  (4) Nationality of the settlers. (To be supported by census data.)

(G) County seat and principal towns.
  (1) Name of county seat.
  (2) Principal towns and their relation to the agriculture of the area.

(H) Transportation, markets, and other cultural features.
  (1) Railroads and highways and the service rendered by them.
  (2) Any service rendered by steamship lines.
  (3) The disposition and marketing of farm products.
  (4) Conditions of public roads.
  (5) Schools, churches, telephones, and other features relating to rural culture and social life.

(I) Industries.
  (1) Important nonagricultural manufacturing industries, mining, and other industries affecting the area should be mentioned and any relationship these have to the agriculture of the area noted. (The plants engaged in processing agricultural products, such as flour mills and cheese factories, are discussed under H (3).)

2. Climate.
  (1) General type, that is, oceanic, continental, etc.
  (2) Variations among seasons.
  (3) Distribution of rainfall during the growing season.
  (4) Influence of physiography and bodies of water on climate in different parts of the area.
  (5) Climate as a factor in the production of special crops.
  (6) Discussion on value of the data on average dates of frost and average frost-free periods.
  (7) Discussion on value of data on average annual means for precipitation.
  (8) Conditions, favorable or unfavorable, for farm work.
  (9) Tables from Weather Bureau of temperature, precipitation, and frosts.
  (10) Discussion of unusual weather conditions, such as winds, storms, and hail.

3. Agricultural history and statistics.
   - (A) Early agricultural development of the area.
   - (B) Important changes that have taken place in the use of the land since settlement.
   - (C) Census data on the agriculture of the area as far back as available and up to and including latest census reports.
   - (D) Present condition of agriculture.
     - (1) Use of fertilizers, lime, and other amendments.
       - (a) Amount and cost.
       - (b) Kind of fertilizers used.
     - (2) Labor.
       - (a) Kind and availability of labor. (Do not discuss the specific wages paid in different farm operations as conditions change from year to year.)
     - (3) Size of farms.
       - (a) General range in the size of farms and the size of the average farm. (To be checked by census data.)
       - (b) Any trends toward change in size of farms and the reasons for such change.
     - (4) Tenure of farms.
       - (a) Percentage of farms operated by the owners and by tenants.
       - (b) Systems of rental, such as cash rent, share of crop, or other.

4. Soil-survey methods and definitions.
   - (1) Description of methods used in mapping soils.
   - (2) Definition of terms used in the description and classification of soils.

5. Soils and crops.
   - (1) General characteristics of the soils of the area.
   - (2) Systems of agriculture practiced.
   - (3) Relationship between soils and agriculture.
   - (4) Grouping of soils on the basis of capability for use.
   - (5) Brief description of each group.
     - (a) Agronomic relationships.
     - (b) Characteristics common to soils in the group that determine use.
     - (c) The names of series in the group and the characteristics of the types of the series brought into this group.

(d) Description of each type and phase of the group, including all the following features, if applicable.

1. Describe each horizon as to :—
   a. Color.
   b. Texture.
   c. Structure.
   d. Consistence.
   e. Thickness.
   f. Reaction.
   g. Content of organic matter.
   h. Stoniness.
   i. Root penetration.
   j. Salt or alkali.
2. Important variations within the type.
3. Location and extent of soil.
   a. General location of the larger areas and definite location of areas of minor types.
   b. Estimate in square miles of areas of each type.
4. Relief.
5. Geologic origin of parent material.
6. Drainage (external and internal).
7. Native vegetation, if important.
8. Uses to which soil is put and crop yields woven in with capabilities of soil. Approximate acreage in different crops.
9. Management of the soil. Systems of management compared with those of area as a whole. Susceptibility to erosion or deterioration from other causes under wrong management.
10. Methods of drainage or irrigation.
11. Water supply if related to soil type.

6. Land uses and agricultural methods.

(A) Capabilities of soils for use.

(1) Crops, (2) native pasture, (3) forests.

(2) Successful and improved methods of management as demonstrated within the area.

(3) Results obtained by experiment on soil types or closely related types, including :—

(a) Use of various fertilizers, lime or other chemical treatments.

(b) Rotations.

(c) Farm implements.

(d) Prevention of erosion.

(e) Tillage.

(f) Drainage.

(g) Varieties of plants.

(h) Plant diseases, insect pests, and noxious weeds.

(This discussion should be specific in respect to the separate soils.)

7. Drainage, irrigation, or alkali amelioration (not always necessary). (Indicate exact meaning of the term " alkali " in each particular report.)

8. Productivity ratings.
(Instructions on this chapter will be supplied in each instance.)

9. Morphology and genesis of soils.
(A) Location of the area with reference to the great soil groups.
(B) Parent materials.
(C) Factors of environment influencing soil development.
(D) Description of normal regional profile and a few of the more important variations.
(E) Character of intrazonal and azonal soils.

10. Summary.
(A) Brief discussion of area and its agriculture.
(B) Uses made of soils and reason for such use.
(C) General statement of the character of the soils.
(D) Brief description of the soil groups and their relation to agriculture.
(E) Names of the principal soils, their characteristics, and their influence on the agriculture.

This outline should be followed in preparing the report, unless some special individual feature of an area makes some change imperative in order to achieve a logical presentation of the material.

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THE BEST USE OF FOREST LANDS

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Presented before the Western Farm Economics Association meeting; Berkeley, California; June 14, 1939

Forest lands of the United States make up a highly important part of our land resources. The areas involved are large; numerous forest products and services are produced; and many economic interrelationships with agriculture and industries exist. Forest areas comprise about 630 million acres, according to reports of the National Resources Board, or nearly one-third the total land area. Lands used for agriculture, by comparison, amount to 415 million acres, and range land 550 million acres.

Any general forest area, such as the national forests, includes many types of "wild land" or vegetation cover, with timber, brush, barren and grass types occurring in different patterns. Some of these types are useful only for purposes such as watershed protection, grazing, or recreation. Most forest lands however, produce lumber and other wood products, and at the same time yield social benefits from these subsidiary uses.

The "best use", or the best combination of uses, on the 630 million acres of forest land is a rather broad problem, but will be considered in this paper as that which contributes most to social welfare. Forest lands would be put to their best use when they make the greatest possible addition to national income, considering both financial and non-monetary returns, over long periods of time.

Utilization of forest resources is of importance to many social groups. Consumers have an interest in low-priced timber products and in the supplementary services provided by forests; labor groups and communities depend on forest employment, while owners of industries are interested in raw material supplies and investment returns. Conflicts between these different interests frequently occur. Certain private incomes are enhanced by scarcity of timber and high values, for example, but society loses when there is relative poverty of useful resources. Policies for social welfare should consider populations receiving direct returns from forest use, others receiving indirect benefits or incurring the social costs of scarcity and depletion, and future generations dependent on the residue of resources which they will inherit.

Trends in forest land use have pointed toward more intensive forest protection and utilization. As timber resources in the East, the Lake States, the South, and more recently the Pacific Northwest have dwindled before a swiftly moving migratory lumber industry, various steps have been taken to prevent further timber depletion. The pioneer attitude of regarding tree cover as an obstacle to agricultural expansion is now found only in limited regions. The forest conservation movement has steadily

gained momentum during recent decades and has in addition spread to other natural resources. Since 1891 the area of national forests has expanded through reservation of public lands and acquisition. Fire protection has been extended to most forest lands under the Weeks Law of 1911 and the Clarke-McNary Act of 1924. Selective logging methods developed in recent years are leaving forest lands in better condition for producing timber crops. Some beginnings in sustained yield forestry have also been made.

While cutover land is now being left in a more productive condition, private forestry is barely launched on a policy of producing continuous forest crops. Most operating lumber companies are still geared to depletion of their virgin stands because of limited timber supplies in relation to plant capacity or because of the financial advantages of quick liquidation. Nevertheless it is estimated that 20 percent of the private forest lands are now being managed under good forestry practices, and over 80 percent are in good condition for growing timber crops.

The past utilization of our forest resources has created many economic and social problems. Decadent communities mark the passing of lumbering operations and wood-using industries. In regions such as Oregon, Washington and California, local cutting exceeds local growth, indicating that the process of abandoning sawmill towns and shifting populations to other occupations will continue. Remaining timber supplies are located far from market centers. Large fire losses still occur, with protection deemed inadequate on more than 40 percent of the private forest lands. Other problems of an overexpanded lumber industry and changing timber demands also exist.

In addition to timber utilization, supplementary uses yielding nonmonetary benefits are of increasing importance. Recreation in timber areas has expanded with amazing rapidity as highways have been extended into forested regions. Users of the national forests increased in number during the last few decades from next to nothing to several million visitors annually. Pressure for hunting and fishing in forest areas continues to increase.

Grazing of livestock on the 334 million acres of forest lands having usable forage is of outstanding importance, particularly to western livestock producers. Summer grazing on forest and mountain ranges supplements the winter grazing and crop agriculture in valley areas at lower elevations, and thus makes possible the continued existence of much of the western livestock industry.

Forest cover is also becoming of increasing importance for protecting watersheds. In areas such as southern California and in many western states the development of agricultural valley lands has intensified the necessity of flood control and the need for stable water supplies for irrigation, power, and domestic use. Expenditures for protecting watershed cover have become increasingly necessary in many river systems to prevent the silting of reservoirs, to insure usable water supplies, and to protect farms, residences, and other investments from flood damage.

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While subover land is now being left in a more productive condition, private forestry is barely launched on a policy of producing continuous forest crops. Most operating lumber companies are still geared to depletion of their virgin stands because of limited timber supplies in relation to plant capacity or because of the financial advantages of quick liquidation. Nevertheless it is estimated that 80 percent of the private forest lands are now being managed under good forestry practices, and over 60 percent are in good condition for growing timber crops.

The past utilization of our forest resources has created many economic and social problems. Decadent communities mark the passing of lumbering operations and wood-using industries. In regions such as Oregon, Washington and California, local cutting exceeds local growth, indicating that the process of abandoning sawmill towns and shifting populations to other occupations will continue. Remaining timber supplies are located far from market centers. Large fire losses still occur, with protection deemed inadequate on more than 10 percent of the private forest lands. Other problems of an overexpanded lumber industry and changing timber demands also exist.

In addition to timber utilization, supplementary uses yielding commonetary benefits are of increasing importance. Recreation in timber areas has expanded with amazing rapidity as highways have been extended into forested regions. Users of the national forests increased in number during the last few decades from best to nothing to several million visitors annually. Pressure for hunting and fishing in forest areas continues to increase.

Grazing of livestock on the 334 million acres of forest lands having usable forage is of outstanding importance, particularly to western livestock producers. Summer grazing on forest and mountain ranges supplements the winter grazing and crop agriculture in valley areas at lower elevations, and thus makes possible the continued existence of much of the western livestock industry.

Forest cover is also becoming of increasing importance for protecting watersheds. In areas such as southern California and in many western states the development of agricultural valley lands has intensified the necessity of flood control and the need for stable water supplies for irrigation, power, and domestic use. Expenditures for protecting watershed cover have become increasingly necessary in many river systems to prevent the silting of reservoirs, to insure public water supplies, and to protect farms, settlements, and other investments from flood damage.

With these trends toward more intensive use of forest lands for timber, recreation, grazing, and watershed protection in mind, attention will be centered on two problems, that of the best alternative use of forest land, and that of the best intensity of forest management.

Alternative Use of Forest Lands

In many regions such as the Pacific Northwest and the Sierra Nevada foothills of California, timber growing, grazing, or crop agriculture are alternative uses. Historically, lands have usually been left for forest purposes when deemed too poor for agriculture. Attempts to farm the so-called "marginal" areas have created such intense social and economic problems, however, that efforts have been made to determine the economically most suitable alternative use.

Any considerable expansion of crop agriculture into forested areas appears rather remote, judging from agricultural trends. In many regions, on the other hand, some crop lands are even reverting to forest. Numerous factors explain the relaxing of pressure for agricultural expansion, such as the loss of export markets, increased use of machinery, and the reduced rate of population increase. An addition to the area of crop land of 30 to 50 million acres may be needed by 1960, according to the National Resources Board, but new crop acreage undoubtedly will be created from tillable pasture and reclamation projects rather than forest lands.

Conflicts between grazing and forestry are somewhat more intense and persist in forest regions of many states where there is pressure for expansion of livestock ranching and subsistence farming. Heated arguments on "brush burning" signify the continued importance of this conflict. although much forest land has been converted into pasture by fire, indiscriminate burning in regions such as the Sierra Nevada foothills has created a no-mans land of brush which produces income for neither stockman nor forester. Intensified fire protection, on the other hand, has reduced grazing capacities on some forest lands once used for grazing by favoring growth of trees rather than grass or browse.

Classifying lands in the marginal grazing-forest zones depends on employment opportunities for the population involved, on trends in demand for alternative products, and on the criteria used. In general, the best use of marginal zones may be determined from the alternative net real incomes realized by all groups affected by utilization of the area in question.1/ The income distribution patterns and the permanence of incomes are also involved in this criterion.

The need of present income for living often forces subsistence ranchers to graze livestock on forest lands regardless of timber destruction or ultimate forest incomes. Pressure of population on resources is characteristic in areas of low productivity, and population pressure

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often forces depletion. To redistribute population, however, involves the difficult task of developing alternative employment.

Classification of land for various uses depends, moreover, on methods of comparing incomes. High rates of discount used in valuing deferred forest incomes result in low values for forest use. On the other hand, very low discount rates, possibly justified for long period valuation from the standpoint of society, may indicate values for long deferred forest incomes equal to or greater than values for grazing use.

National policies affect land classifications by influencing agricultural and grazing pressure on the remaining forest lands. Thus if the unemployment problem gets bad enough to force a partial reversion to pioneer conditions, the best use of some land now in forests might be for subsistence farming. With such a movement subsidies would have to be given to maintain anything but pioneer living standards.

Realizing best use of forest lands thus involves a land-use classification, based on general economic trends and on prospective incomes accruing to all social groups. Making classifications effective usually will require controls such as zoning or other legislation.

In addition to competitive relationships, forestry and agriculture are often supplementary uses. The system of permanent forestry in Europe is built to a large extent upon the use of resident labor deriving agricultural income from small farms in forest regions. In many parts of the East where farm woodlots and well-distributed forests are common, more complete utilization of agircultural labor can be promoted by appropriate forest policies. In our western states seasonal labor requirements for agriculture and lumbering coincide to such an extent that a close supplementary relationship usually does not exist. Nevertheless, income from forest work or lumbering constitutes an important element in the support of many subsistence ranchers located in or near forest areas.

On residual forest lands not claimed for crop agriculture or grazing, foresters have the task of balancing competitive and supplementary forest uses. Many combinations of timber production, recreation, water conservation, wild life production, and grazing occur on forested lands. Where there are "islands" of resources adapted to one specific use, as in the case of lakes or meadows in timber areas, the problem is primarily one of administering the intermingled recreational or grazing uses by a single forest management organization. Combining uses on given areas of forest land is often a difficult economic problem in forest administration. Recreational activities such as hunting and camping characteristically are found on areas used primarily for timber production. Other combinations of subsidiary uses and timber growing frequently occur on a given area. One of the main economic objectives in forest planning is to balance these various forest uses so as to obtain the optimum output of monetary returns and indirect social benefits. Production of goods and services from several forest uses justifies spending funds for protecting and developing lands of relatively low values.

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Intensity of Forest Land Use

The determination of best alternative land use and the best combination of forest uses is thus of major importance in forest planning, but a classification of the residual forest lands for management intensity is also needed. We have approximately 460 million acres of "commercial" timber lands with wide variations in stands, growth and accessibility. Producing timber on these lands raises questions of the desirable intensity of management, and the allocation of areas between public and private ownership. Extreme variations in management are possible, varying from limited fire protection to an intensive forestry.

For a classification of management intensity accurate forest inventories of stands, growth, and drain are needed, together with economic analyses of prospective use and demands. The desirable intensity of management depends, like alternative uses, upon a number of economic factors and trends.

One factor of major importance, for example, is the amount and distribution of timber supplies in relation to drain. Through the last few decades warnings of timber famine have been frequent, some emanating from conservationists and others from industries producing wood substitutes. Much of the alarm of 30 years ago was justified in view of the long upward trend in wood consumption, underestimates of timber supplies, and large fire losses. Since 1906, however, annual lumber production has fallen from 45 to about 20 billion board feet. Substitute materials have been used increasingly for products such as fuelwood, posts and poles. On the other hand, the use of wood for paper, rayon, plastics, and other cellulose products, though relatively small, has shown a strong upward trend.

As a result of reduced wood consumption and regrowth on cutover lands, timber growth and drain now practically balance for the country as a whole. Wood supplies are sufficiently plentiful that a future shortage is no longer probable. In contrast, fears are even expressed that future markets may not absorb prospective timber production.

Although timber exhaustion appears remote, many economic problems of distribution and local depletion still remain. In eastern regions consumption exceeds local supplies, necessitating costly timber imports from other regions such as the South and the Pacific Northwest. It would appear to be socially economic to spend money for fire protection and timber growing in the deficit regions and at least reduce the amount and cost of timber imports. Total wood utilization is balanced by volume growth, but large trees and valuable species are being used, whereas regrowth occurs on small trees of inferior quality.

Demand factors are of particular significance in planning the use of commercial forests, since the marketing of products must be recognized as the mainspring of industrial forestry. What consumers will pay for conversion of trees into lumber, paper, and other products will determine long-time employment and capital returns. Investments in timber growing should be governed by prospective demands for timber products, with an

Intensity of Forest Land Use

The determination of best alternative land use and the best combination of forest uses is thus of major importance in forest planning, but a classification of the residual forest lands for management intensity is also needed. We have approximately 400 million acres of "commercial" timber lands with wide variations in stands, growth and accessibility. Producing timber on these lands raises questions of the desirable intensity of management, and the allocation of areas between public and private ownership. Extreme variations in management are possible, varying from limited fire protection to an intensive forestry.

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adequate reserve of publicly-owned timber for emergencies or for production in response to new demands. In the light of present trends in wood use and population growth, it is estimated that future wood consumption will vary from recent levels of about 14 billion cubic feet up to 19 billion cubic feet of wood annually. Many national policies affecting population, employment or construction activity, however, will influence actual market demands for timber products.

The intensity of management on forest lands is also influenced by national policies such as those involving tariffs. The tariff increases in 1930 and subsequent foreign retaliation explained in part the loss of foreign markets by domestic producers of Douglas fir, redwood, and other lumber species. Proposals for tariffs to enable wood producers in the United States to supply all our pulpwood and paper requirements involve a choice between national welfare and benefits to forest industries. Since more than 50 percent of our pulp and paper consumption is imported, diverting demands to domestic forest industries would increase the intensity and profitability of forestry in this country, but at the same time exports of other products from the United States undoubtedly would be reduced.

The desirable intensity of management for timber-growing lands is also beclouded by a number of other economic factors. Over-optimistic investments have been made in the purchase of many large timber holdings. Subsequent installation of sawmills created capacity almost twice that required to produce even the peak lumber demands of the predepression years. The need for income to meet heavy interest payments on bonded indebtedness, taxes, and protection costs in turn necessitated either rapid timber liquidation or bankruptcy. At the same time declining demands for lumber in both domestic and export markets aided in bringing about lower prices and profits than expected. Low investment returns in an over-expanded lumbering industry have darkened the outlook for sustained yield forestry. The existence of thousands of small timber holdings as well as excess capacity has tended to intensify competitive conditions in the lumber industry.

The deflation of speculative timber values and an apparent need for reduction of plant capacity have many counterparts in agriculture and industry. If economists can find desirable means of curing agricultural "surplus" problems, perhaps foresters can adopt the same methods for solving these problems of timber production.

While short-run influences often make forest investments appear unattractive, economic incentives favor more intensive management and permanent forest industries. Frequent cutting by selective logging methods has been made possible in most timber regions by the development of roads and efficient tractor and truck equipment. Cutting the larger high-value trees usually makes possible the early liquidation of a large part of forest investments, and at the same time converts stands into growing stocks of vigorous trees capable of rapid value increment. Studies in regions such as the pine belt of the Sierra Nevada foothills indicate the feasibility of obtaining high rates of earnings on trees left in selectively cut stands. It is essential that owners initiate selective cutting methods before timber reserves are depleted, however.

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The criticism of speculative timber value and to stimulate good forestry protection of plant capacity have been considerable in agriculture and industry. If economists can find workable means of making agricultural "marginal" problems, perhaps foresters can adopt the same methods for solving these problems of timber production.

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Forest management for continuous timber crops is also being influenced by trends in interest rates. Low earnings in timber industries in the past have resulted in pressure to liquidate investments in order to reinvest in alternative enterprises promising greater returns. Declining trends in interest rates, bringing about levels of 3 to 5 percent and even less for industrial bonds, place even low earnings of forest investments in a more attractive light. These economic trends favoring continuous management and incomes over long periods are of considerable importance since forest use on the large areas of private lands will be determined by prospective profit if private initiative is preserved.

In view of trends in timber consumption and prospective timber supplies, it appears to be wise policy in the case of the depleted and poorest forest lands to provide only protection from fire in order to preserve watershed values and adjoining timber. Young stands on accessible areas, on the other hand, promise returns on investments in protection and stand improvement. Remaining virgin forests, in particular, often may be managed profitably for sustained yields when of high growth capacity and accessible to markets, and when excess plant capacity does not compel rapid depletion. The better forest areas may be expected to yield a differential rent from the production of timber crops.

Large areas of depleted cutover and poor timber lands offer few inducements to private management, since incomes will be limited and long deferred. With public ownership, there is a question as to how great ultimate returns on present expenditures must be to become "profitable". Public outlays to rehabilitate forest resources often show promise of little net return, yet productive timberlands will benefit future generations. Many recent expenditures to maintain forest resources, moreover, have been made by public agencies as part of an emergency spending program, and standard cost accounting systems do not indicate the profitability of public investments when unemployment of labor and capital is prevalent. Nevertheless, alternative incomes from investments of relief funds should be appraised in a national planning program when expenditures can be made for hospitals, housing projects, or production of commodities.

The allocation of public funds for forest protection and management at various degrees of intensity is important in forest planning. Since privately owned lands are of greater area and value than publicly owned lands, forest investments might be made most economically if concentrated on the more productive private forests where returns are potentially greatest. Spending public funds on private lands is justified by the social benefits from cheaper forest products and from the supplementary forest uses which yield non-monetary returns.

Policies to Promote Best Forest Use

Forest policies to make effective the classification of lands for combinations of forest uses and for intensity of timber management may be summarized briefly as (1) provide adequate fire protection on all forest lands to insure some kind of vegetation, (2) promote intensive forestry on the more productive lands to produce timber for prospective demands,

Forest management for continuous timber crops is also being influenced by trends in interest rates. Low earnings in timber industries in the past have resulted in pressure to liquidate investments in order to reinvest in alternative enterprises producing greater returns. Declining trends in interest rates, bringing about levels of 2 to 3 percent and even less for industrial bonds, place even low earnings of forest investments in a more attractive light. These economic trends favoring continuous management and thinned over long periods are of considerable importance since forest use on the large areas of private lands will be determined by prospective profit if private initiative is preserved.

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Policies to Promote Land Forest Use

Forest policies to make effective the classification of land for combinations of forest uses and for intensity of timber management may be summarized briefly as (1) provide adequate fire protection on all forest lands to insure some kind of vegetation, (2) promote intensive forestry on the more productive lands to produce timber for prospective demands.

(3) expend funds for forestry purposes according to timber growing capacity and prospective benefits, (4) foster permanent operations to maintain stable communities and industries.

Policies designed to attain the best use of forest lands apply chiefly to areas in private ownership. Privately owned lands make up three-fourths of the commercial forest area, and include the most valuable timber and the more productive sites. Farm woodlots alone comprise 30 percent of the commercial forest area. Sixty percent of the remaining saw timber is privately owned. Ninety percent of the potential forest growing capacity and 95 percent of the forest drain is on private lands.

Public measures for obtaining the best forest land use and the best intensity of management include public ownership, cooperation with private owners, and regulation of forest practices on private lands.

Public ownership at present extends to only 120 million acres of commercial forest lands, or about one-fourth of the areas best suited for timber production. Additional public lands with forest cover but suited primarily for subsidiary uses other than timber production amount to about 100 million acres. Most public timber lands are in national forests, although state, community, and other federal ownerships are also important. While generally of less value than private forests, most public areas are under fairly intensive management for combinations of timber production, grazing, recreation and other land uses.

Moderate increases in the area of public forests appear probable, particularly for low value, depleted, and tax delinquent lands. Other watershed and public recreational areas should also be publicly owned where returns are non-monetary and widely diffused. Public acquisition of the 340 million acres of commercial forest lands in private ownership is at present of little more than academic interest, however, in view of the large transfer of funds that would be necessary.

Cooperation between public agencies and private landowners has become increasingly important, with public agencies resorting to subsidies to obtain better forest practices. Financial and other aids are given to promote forest protection, selective cutting, and permanent operations. In view of the public interests involved, this policy of assistance in return for maintaining forest lands in productive condition should be continued. Providing more adequate protection from fires, insects, and disease through Federal and State agencies is not only economically feasible, but justified by social values in forest lands and in the case of fires by responsibility of the public for causing heavy losses. A public system of low cost forest fire insurance would increase the security of private forest investments. Federal credits at low interest rates, modeled along farm credit lines perhaps, could promote permanent forest industries. Taxation of forest land should be adjusted for sustained operations. Cooperative producing and marketing associations could be fostered as a means to better forest utilization. Research in forest management and marketing should be continued.

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In addition to public ownership and public assistance, regulations to obtain desirable forest practices may be applied where needed. Reasonably effective public controls to insure slash disposal and fire protection have been initiated by various states. The short-lived NRA attempted to improve forest utilization practices through "industrial self-government", but uniformity of regulation and control of minority elements was found to be difficult. It is possible that additional public controls over forest use may be necessary, similar perhaps to those in countries such as Sweden where intensive forest protection, approved cutting methods, and planting are compulsory and accepted features of forestry. Costs in excess of those for quick liquidation may be involved, but such expenses are borne by all forest owners and become part of the timber supply price. The social philosophy regarding regulation in the United States has not crystallized in favor of complete public control over the use of natural resources. Trends in zoning and urban regulations nevertheless indicate that public control over land utilization ultimately will replace the philosophy of laissez-faire in order to protect social values in forests or other natural resources.

The best use of forest lands may thus be approached through classifications for alternative uses, for combinations of supplementary forest uses, and for intensity of management. Such classifications should rest upon economic analyses of the ultimate costs and benefits to all social groups. Land use policies involving a combination of public ownership, assistance to private landowners, and public regulation of forest practices appear desirable in order to realize productive forests, profitable and stable industries, and permanent forest employment.

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Discussion by Paul A. Eke
University of Idaho

of

THE BEST USE OF FOREST LANDS

by

H. R. Josephson
California Forest and Range Experiment Station

There are at least two features of this paper that make it of unusual value to all those interested in land planning. The first is the display of goals which can be used as gauges of best use. These goals are equally applicable to appraising or planning other land uses. Dependable goals have been so much needed in many of the recent action programs that a review of those given here seems to be justified in the light of giving them the emphasis which they deserve. A broad general statement of these goals is given in this paper. To get a more specific statement, I am quoting from the May, 1939 Journal of Farm Economics. In this issue, David Weeks and H. R. Josephson list the following goals:

"1. Increased per-capita net real income.
2. Reduced dispersion of income.
3. Permanence of income."

These goals may well become the socio-economic philosophy of all economic planners, particularly, of those dealing with land. One example is, perhaps, sufficient. Trends in agriculture toward large mechanized farm units, which frequently go far beyond the point of the "least cost combination", could well be judged in the light of these goals. A land use program emanating from such an application might be rather startlingly effective in solving the surplus population problems of agriculture in areas which have the best farm lands. As a further result, subsistence farming on cut-over forest lands might not then be quite so necessary for some people. The second feature is the optimism concerning sufficient growth of timber, together with mature stands to adequately care for our immediate and distant future needs. This statement is a bright ray of light piercing the gloom which has been created by most writers on this subject during the last twenty or thirty years. Perhaps somewhat more emphasis should have been given to local exceptions. Depletion and lack of sufficient growth prevail in areas nearest to market.

Statements concerning required intensity of management for forests of different qualities are appropriately made. The theory of efficiency, capacity, and productivity might well have been used in this connection. That public funds have not been spent on this basis is not over-emphasized. Some rather poor national forests have had more than their share of public funds. In this connection, there seems to be a need for considering

Discussion by Prof. A. Ge
University of Idaho

of

THE FEN ELK OF YELLOW LAKES

by

L. A. Tomlinson
California Fish and Game Department, Bishop

There are no longer any factors of this group that make it necessary to be all about interested in this subject. The first is the digest of a well-digest, as the best or means of year-end. These goals are equally a matter of preference or choice, other than any. Be-publication, well-have been so, not, because in many of the number cases previous work a review of the [illegible] were made to be justified in the light of giving them the [illegible] which they deserve. A great amount attention of these goals is given in this paper. If not a more specific statement, I am quoting from the [illegible] of [illegible]. In this issue, David [illegible] is [illegible] the following points:

"1. Increased [illegible] and [illegible].
2. Reduce [illegible] of [illegible].
3. [illegible] of [illegible]."

These goals are well [illegible] socio-economic [illegible] of all economic [illegible] [illegible] with [illegible] and [illegible]. The [illegible] simple is, [illegible], [illegible]. [illegible] is [illegible] [illegible] [illegible]

shifts in public expenditures from public to private forest lands. These expenditures might be made to correspond with fulfillment of required forestry practices on the part of private timber land owners. This would be similar to payments to farmers for soil conserving practices under the Agricultural Adjustment Administration.

Questions are raised concerning the advisability of using relief labor for improvement of forests. This seems entirely proper. As an example, it appears that this labor might in some instances be used more productively in conserving human resources. This goal might result in improving subsistence communities found on cut-over lands by moving some of them to the best available lands, making closer settlement, and building roads and schools.

Statements on federal forest credits, fire insurance, and taxation reform all sound familiar to the agricultural economist. There seems to be no reason why similar measures might not be justified for forestry, particularly, to promote farm and small-scale forestry.

Sawmill "over-capacity" might well have been discussed along with the large element of monopoly price control which exists in many areas. Lack of price competition among retailers is another matter of grave concern in respect to "over-capacity" of sawmills.

The relation of tariff manipulation to foreign lumber demand has been treated briefly. Perhaps one should add to this statement the need for exchange by foreign nations if lumber is to be purchased from the United States. This will involve lower industrial tariffs to permit greater importations. The lumber industry is, it appears, in about the same position as wheat and cotton producers who must depend upon foreign sales for a large part of their income. From the same sources inspiring some farmers to ask for higher tariffs, not a few lumbermen think that the cure for the evils of high tariffs is more high tariffs; particularly, on their particular products.

Under the section entitled "Alternative Uses for Forest Lands", some consideration is given to settlement of cut-over lands for agricultural use. It is the conclusion that not much more will be cleared unless, to quote, "the unemployment problem gets bad enough to force partial reversion to pioneer conditions." The facts are that such conditions now prevail and have prevailed since 1933. These lands are being cleared now, by a local surplus of rural population, by drought-stricken farmers from prairies, and by some unemployed industrial people. Cheap improved lands mean nothing to any of them since they have meagre funds with which to purchase. Farm lands in older areas reverting to timber may offset this new clearing, but this clearing will, no doubt, continue indefinitely.[1] There is a serious need of preventing exploitation of these people by owners of cut-over lands, both as to prices asked

---

1 Recently Cooperative "Bulldozer" Associations have been formed throgh the Farm Security Administration, which are cutting costs of pulling stumps to one-fourth or less--as little as $7.00 per acre in northern Idaho.

[illegible]

and as to quality of lands sold. The need for land classification and zoning becomes apparent in this connection. Legislation designed to prevent onerous land contracts for these cut-over lands, and for that matter on all farm lands, might well be considered.

More might be said about "brush burning" on protective forests. Such burns seem definitely beneficial for game ranges as well as for livestock grazing under certain conditions. This is particularly applicable for elk on their winter ranges.

An active public opinion which backs up rangers in allotting the correct amount of grazing rights on the national forests is desirable. Here again, the goals of "increased net real income", "reduced dispersion of incomes", and "permanence of income" need to come to focus. In general, this paper is a brief, clear, concise statement of the best use of the forest lands in the light of current economic and social trends.

Working material for
B.L.M. Conference
July 11 - 19, 1952

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LAND MANAGEMENT PROBLEMS OF THE BUREAU OF LAND MANAGEMENT

By: R. S. Kifer, Chief
Division of Lands

Preceding papers in this series have covered quite thoroughly the problems of the management of resources on the public lands. To manage resources there must be some assurance of tenure and control. How else can long-time contracts or development processes be undertaken? Consequently, it must be assumed that the public domain, placed in particular uses, such as forestry, recreation, or defense, be protected from claimants and that tenure for grazing, resource development, and protection of resources not be disturbed.

The management of the public lands under existing laws has, therefore, some unique problems not common to the management of the resources on those lands. Management of the land implies authority to either retain or dispose of land, whichever action is in the public interest. It is generally recognized that indiscriminate disposal of the public lands ended sometime between 1900 and 1930 and that management of lands dovetailed into the general policy at about the same time.

CHANGES IN PUBLIC LAND POLICY

The change in attitude, which shifted public thinking from a philosophy of private ownership solely to one of public management of some lands, is an interesting phase of our public-land history.

In the past 200 years the pattern of ownership and use of four-fifths of the land in the United States has undergone a complete change. The title to approximately 80 per cent of the total area which at one time was Federal lands has been transferred to private ownership. Some of the more difficult problems of managing the remaining public domain arise from the fact that laws designed to meet a situation in the humid eastern areas or in the more productive middle western States are still applicable to arid land of the West.

The policy of alienation was developed at a time when land was the most abundant commodity in the country. Progress of the United States depended upon the use of natural resources. The immediate economic interest of individuals and communities lay in the exploitation of these resources, regardless of the consequences to future values or productivity. Agricultural values were regarded more highly than any other. This may have been because the soils and climate in the eastern and middle western States were such that nearly all of the land had a high potential value for crop production. Furthermore, the agricultural use of the land was adapted to the techniques, the equipment, and the capital that was available to persons at the time. Rapid

and almost unregulated disposal of land in small operating units was a practical means of developing the agricultural resources and establishing quickly a self-sustaining economy. Multiple values which are emphasized so strongly today were present then, but recognition of these and the interest in public land values had to await growth of population and full economic development of the surface resources.

The shift in emphasis from disposal to one of retention and management had a sound economic foundation. True, the remaining public land is less productive for agriculture than the land which was settled during the last century, but with the maturity of the country has come the recognition that the values of certain developed tracts depend largely upon resources which originate in other areas. The Bureau of Land Management's policy in watershed management and in the conservation of underground water recognizes that the retention of certain tracts on which other areas are dependent is in the best public interest, if we interpret the public interest as being the most complete use of available resources and the protection of agricultural and other established interests. The Bureau has now to decide whether land will be retained in Federal ownership, whether it can be better managed by the States, or will yield its greatest values in private ownership and direction. Nevertheless, we are still operating under laws which were passed before the first transcontinental railroad was built, when the total population was less than 25 million and when less than 300 million acres of land were in farms.

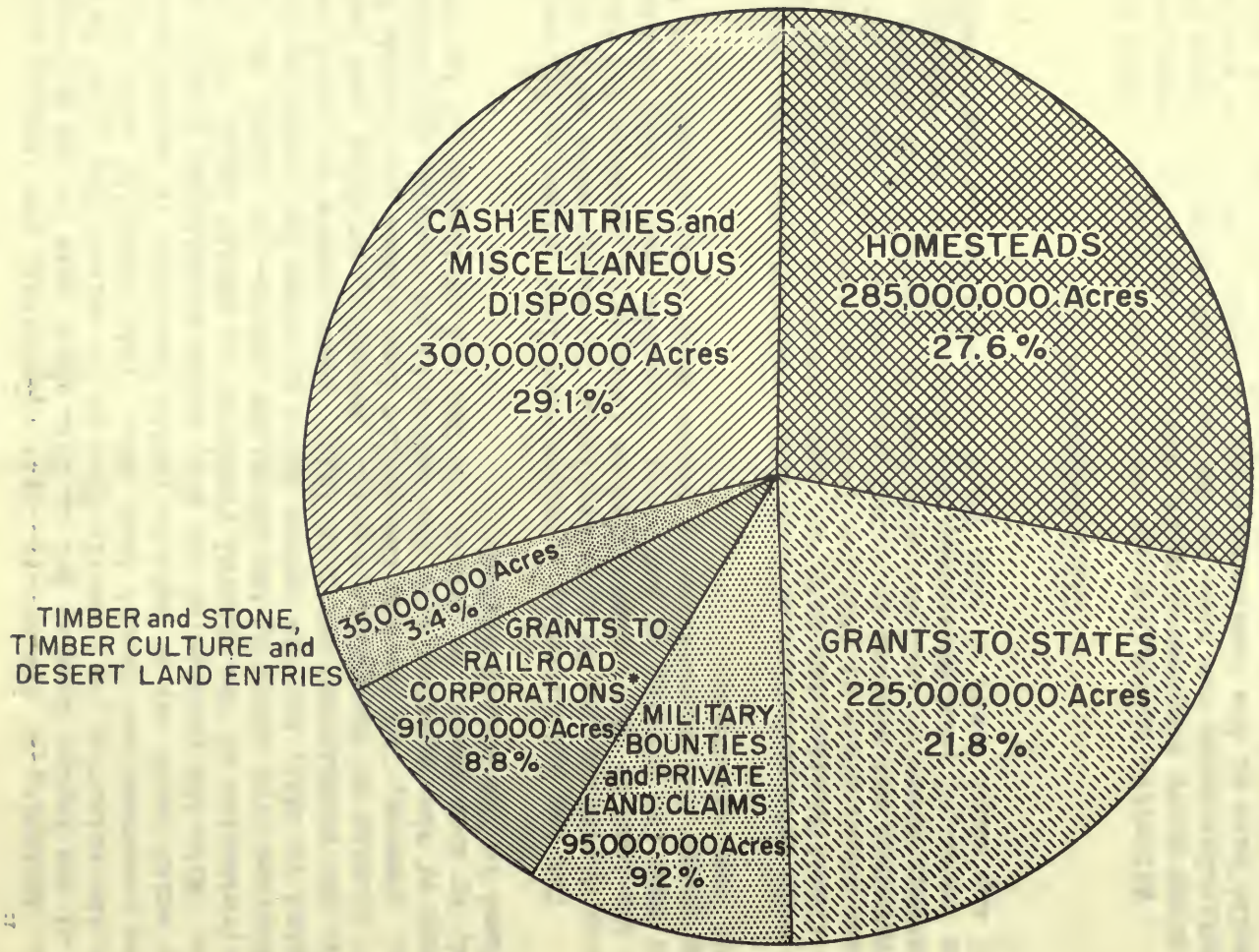
The history of the public domain and the evolution of public land policies is an interesting subject and one which explains many of our current problems. Chart 1 summarizes the disposals of land through grants to states and corporations by cash entries and sales and under the homestead laws. Altogether, title to more than one billion acres of public land has been transferred under one or the other of these laws.

RECENT TRENDS IN LAND ADMINISTRATION

Land disposals, as such, have declined from approximately 3 million acres per year at the beginning of 1910 to not more than 300,000 acres per year in 1950. The authority for control and management of 187,000,000 acres of remaining public lands rests primarily with the provisions of the Taylor Grazing Act. This Act in addition to providing for the management of grazing lands under grazing districts and the leasing of other tracts for grazing purposes, grants to the Secretary of the Interior the authority to classify land prior to disposal, yet includes the authority to make exchanges of public land for State land and, when it is in the public interest to do so, to exchange private land for public land. These with the provisions for the sale of public lands are the important working tools which the Bureau of Land Management employs for its program in land management and protection.

CHART No. I

APPROXIMATE AREA OF THE PUBLIC DOMAIN DISPOSED OF UNDER THE PUBLIC-LAND LAWS



* Exclusive of revested area

TOTAL DISPOSALS 1,031,000,000 ACRES

MANAGEMENT OF PUBLIC LANDS

Authority to dispose of lands selectively was lacking until the passage of the Taylor Grazing Act in 1934 which gave to the Secretary of the Interior the authority to classify land as to suitability prior to disposal under the homestead and desert land laws. This authority also provides the means by which lands may be held in public ownership in connection with public programs. With the passage of the Act, which established grazing districts for the protection of the natural resources on public lands, all public lands were withdrawn from entry by two Executive orders--the first, No. 6910, was promulgated in 1934, and the second which withdrew the remaining public lands, No. 6964, was promulgated early in 1935. These orders are sometimes credited with the closing of the public domain. Actually, existing land laws were not changed. However, the law and the public land orders did provide the Department of the Interior with the authority to control applications for land and, by this means, to direct the use and settlement of the remaining public land in the United States.

The law specifically provides that land either within and outside of grazing districts can be made available for entry under existing land laws if the land is first classified as being more valuable for the purpose intended than for grazing or for other alternate uses. Land is also classified as being proper for acquisition by States under lieu selection or through the medium of land exchanges.

An interpretation of this Act, consistent with the usual definition of land classification and with the administration of public land areas, would have zoned areas of land for particular uses. In practice the Department of the Interior has elected to accept applications for land by tracts except where certain areas of land are withdrawn by specific land orders. This puts upon the Bureau of Land Management the responsibility for classifying for disposal any small tract of land which an individual or State desires to acquire.

TRACT CLASSIFICATION

Effective classification can be done only by a careful study of entire areas where consideration is given not only to the resources and values of a particular tract but also to the influence which the change in use of one tract would have on the remaining areas of public lands. We are required, however, by custom to act on each application however made and for whatever purpose. Applications are made for homesteads, public sales, exchanges, desert land claims, and other purposes.

During the fiscal year 1951 1,648 tracts embracing 563,000 acres were classified as suitable for disposition as homesteads, desert land claims, exchanges, or public sales, and during the same period 985 tracts embracing 428,000 acres of lands were classified as not suitable for disposition. In addition, approximately 21,000 acres were classified as being suitable for lease and sale as small tracts.

AREA CLASSIFICATION

The land classification activities of the Bureau in 1951 included area studies, primarily in the Missouri River Basin, which classified 110,000 acres as suitable for disposition and classified 1,068,000 as not being suitable for disposition. Of nearly 8 million acres examined under the program to date 260,000 were designated suitable for disposition. One of the most acute needs of the Bureau in its land classification work is for more basic information on the condition of the public lands, the soils, degree of erosion, and availability of water and productivity. If area classifications gave this information for all of the public lands in the United States, the Bureau would have a basis for laying out long-time plans for the development and use of resources on the public domain. Without the general classifications, action on an application for any segment must be made with little regard for its effect on other public lands or on the economic activities in the area. At the present time only about 4 per cent of lands are so classified, and although the value of these studies in the management and disposal of lands has been amply demonstrated, little progress can be made until funds for this work are made available.

THE PATTERN OF PUBLIC LANDS

Chart 2 shows the dispersed nature of public lands in one area. Simplified for presentation it shows holdings of private land, blocks of state lands, reservations for public uses such as national forests, fish and wildlife, stock driveways, and water reserves. Land reserved for development by Federal programs for irrigation and for development of water resources, Indian reservations, national parks, reserves for state or local community purposes, reserves for watershed protection, and land held for the development of grazing and forestry resources, which are present in other areas add to the complexity of the public land management pattern.

Some of the scattered isolated tracts of public land could be effectively administered as private lands and undoubtedly some of the patented tracts mingled with public lands would be more productive under public management.

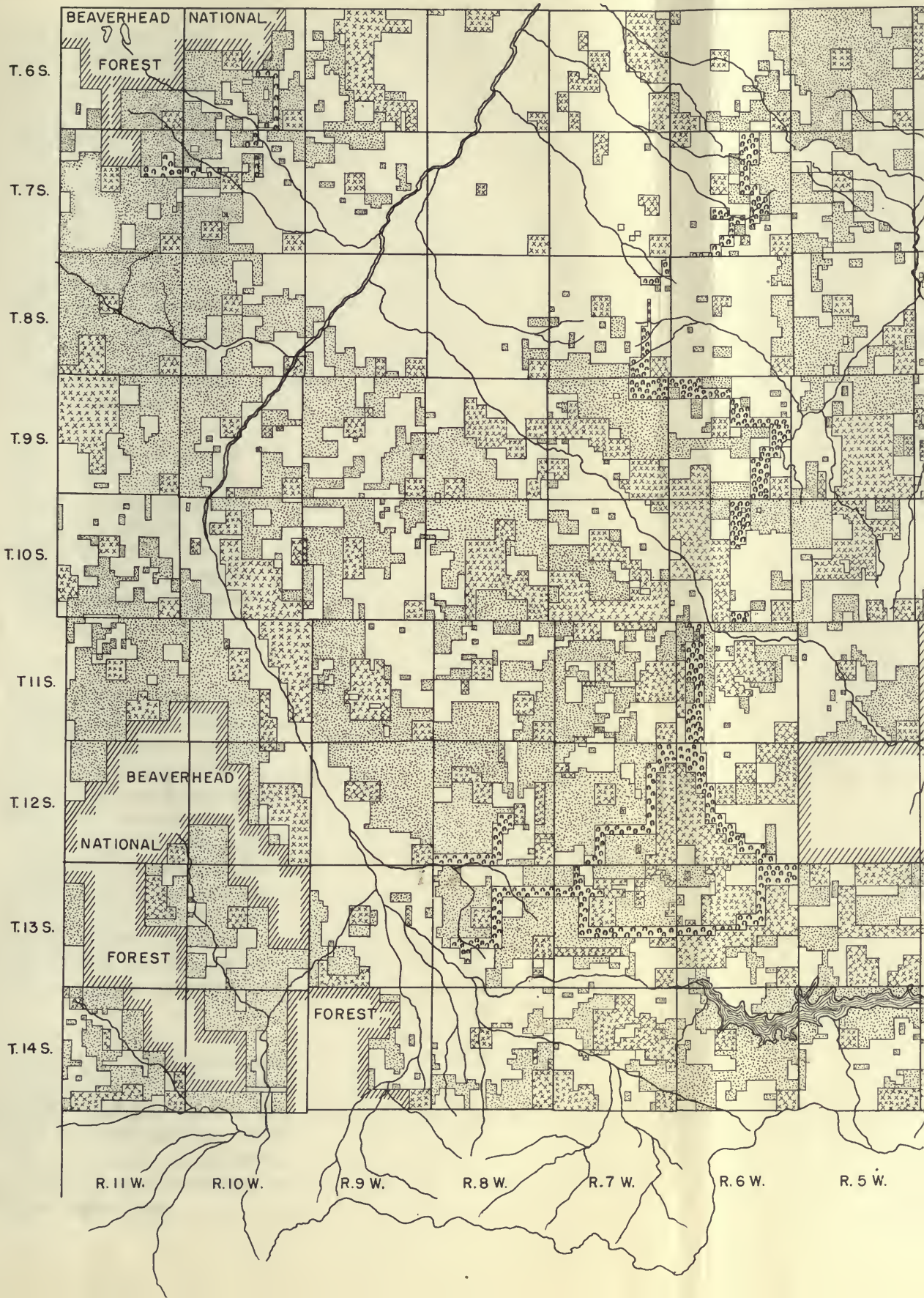
A carefully worked out program for an improvement of the pattern would involve the selective sales of public domain and exchanges of public for state or private lands. Some areas would probably be classified for small tract development. Area studies may show some vacant lands suitable for homestead or desert land entry.

LIEU LANDS AND EXCHANGES

The Taylor Grazing Act provided specifically that States which had not been granted their full acreage of lands for the support of State institutions could select an alternate area from the remaining public lands. It provided also that under certain conditions the States could exchange State lands for public lands and also that the Government could, when in the public interest, exchange public lands for private lands.

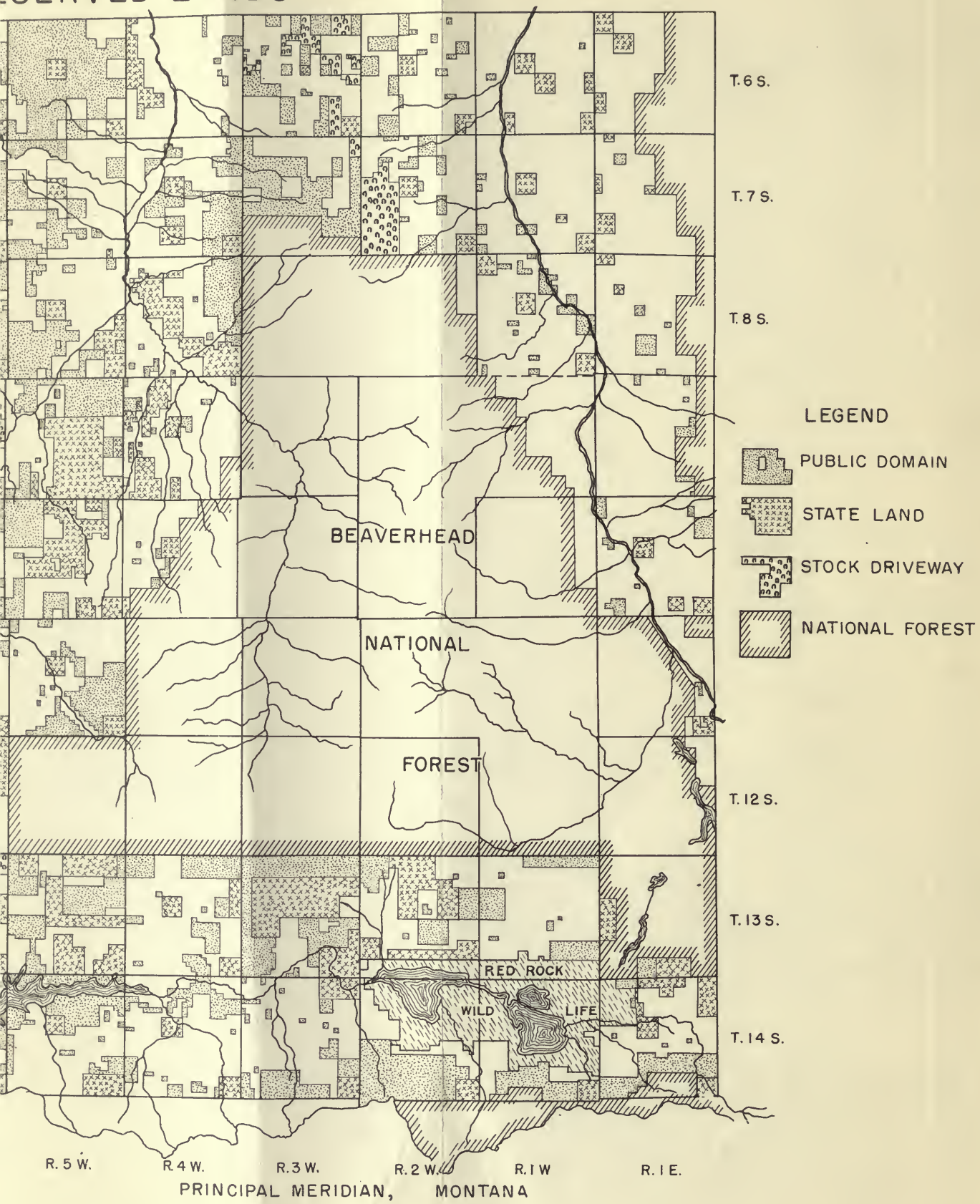
CHART No. 2

LOCATION OF BUREAU OF LAND MANAGEMEN
PRIVATE AND RESERVED



No. 2

IAGEMENT LANDS IN RELATION TO ESERVED LANDS



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STATE SELECTIONS

The right of lieu selection was no more than the confirmation of the land grants to States which date from early public land history. An ordinance, dated 1775, reserved one section (section 16) in each township as a school grant for the territory of Ohio. This policy was continued with the organization of the States with a tendencey for more liberal grants of lands to the States. When Utah, Arizona, and New Mexico were admitted to the Union, each State was allowed four sections of land in each township. As some of the specified townships granted to States had already been appropriated or were included in Federal reservations, States were granted the right to select substitute areas from remaining public lands. An Act in 1891 extended the principle of indemnity selections in lieu of appropriated land in school sections to provide for the selection of lands in lieu of lands embraced in Indian, military, and other reservations. In some of the Western States where large areas of land are withdrawn for specific purposes, such as national forests, the indemnity selection presents a considerable problem in public land management to the States as well as to this Bureau.

Some of the States have exercised most of their lieu selection rights. Others do so only when it is apparent that a particular tract of public land may be disposed of to the advantage of the State. The selection of isolated or key tracts by the State may disrupt a carefully planned program of management on public lands. In the interest of good management the Bureau should endeavor to clarify the position of State lands, particularly in those States where considerable areas remain for selection.

STATE EXCHANGES

The Taylor Grazing Act provides also for exchanges of public land with the States for land of equal value or of equal acreage. Since 1947, exchanges have been made only on the basis of equal value. The Act directs the Secretary to proceed with exchanges with the States when lands selected by the State within grazing districts lie in a body so located as not to interfere with the administration of or with the value of public lands. The Department can reject State applications for exchanges of land which is needed for particular public programs. This authorization for exchanges provides the Bureau with machinery which could be beneficial to the land programs of both the Federal and State Governments. To make effective use of this authorization, however, the Bureau will have to take some initiative on exchanges, first to locate lands available for exchange with the States, and second to propose exchanges that will be advantageous to all management programs.

Exchanges have been proposed to States by other Federal agencies for state lands within reservations. In these cases the selected lands usually come from areas managed by the Bureau of Land Management. As neither the State nor the Federal agency is concerned with the Bureau of Land Management programs, the proposed exchanges, however beneficial to the particular agency, may disrupt completely programs of the Bureau of Land Management or sometimes those of other agencies.

DISPOSAL OF SMALL TRACTS

The traditional land laws of the United States were drawn to grant public land either for agricultural purposes or to exploit the resources carried with the land. Except for town sites the need of land primarily for homes and other site purposes was not recognized until 1938. The Small Tract Act provides that land suitable for homes, recreation, health, cabin, or business sites may be obtained through lease or through lease with an option to purchase. As shown by Chart 3 this is a rapidly expanding phase of the public land business. Nearly 200,000 acres of land have been classified as suitable for small tracts. From the standpoint of numbers of applications, this program has become the most important of the Bureau's disposal operations. Of approximately 40,000 units varying in size from $1\frac{1}{4}$ to 5 acres, approximately 20,000 have been leased with the option to purchase, and an appreciable number have already been sold. Sales of small tracts have been running between 100 to 200 a year, but as present leases expire the number sold is expected to increase rapidly. This program makes land available as needed in expanding communities and provides land in small areas for specific purposes, and at reasonable prices. Through this means individuals may obtain tracts of land for recreation or for part-time residences.

Establishment of military installations, defense plants, and other industrial developments in areas which are predominately public land areas have given rise to a demand for homesites. Generally speaking, the use of land for small tracts is considered to have a higher value than use for alternate purposes. There may be some exceptions, particularly in this period of high timber and other prices, but in competition with values for grazing or for agricultural uses, the small tracts usually have a definite value advantage. This phase of the Bureau program can be expected to continue so long as the population pressures increase in the Western States.

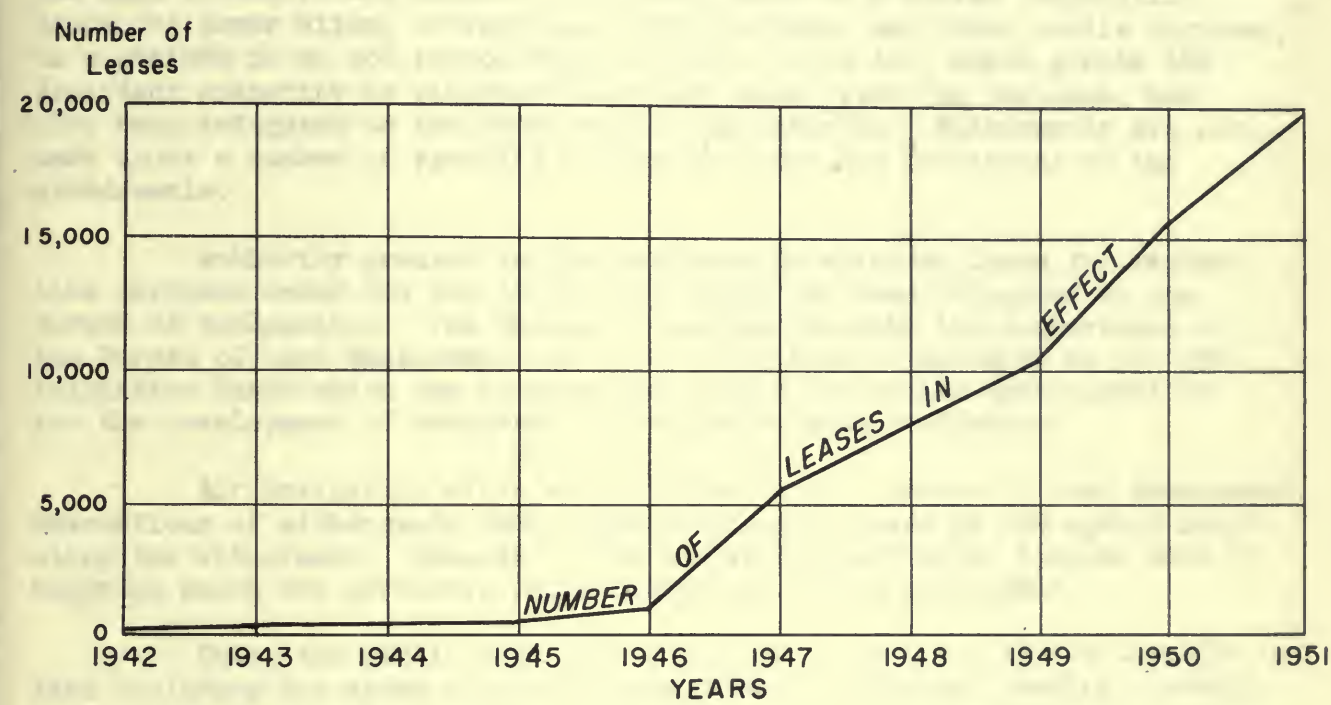
WITHDRAWALS, RESERVATIONS, AND REVOCATIONS

Reservations of public lands are the basis for the operations of Federal land agencies in the West. There are about 408 million acres of public land left in the United States. Of these approximately 139 million are reserved as national forests; 56 million are in Indian reservations; and 12 million are held as national park and monument areas. Approximately 11 million are retained in defense reservations; 9 million in reclamation areas; 7 million in power and water reserves; 4 million in stock driveways; and 1.6 million in fish and wildlife areas.

The Bureau of Land Management has control over nearly 180 million acres, most of it in grazing districts, but not for other specific purposes. As the programs of the civil and military agencies develop, requests for reservation of areas of public land are made to the Bureau. Military agencies, and others, do not hesitate to request withdrawal of public lands from all entry in order to carry out their programs and because of existing

CHART No. 3

AREA CLASSIFIED FOR SMALL TRACTS, AREA LEASED AND NUMBER OF LEASES IN EFFECT



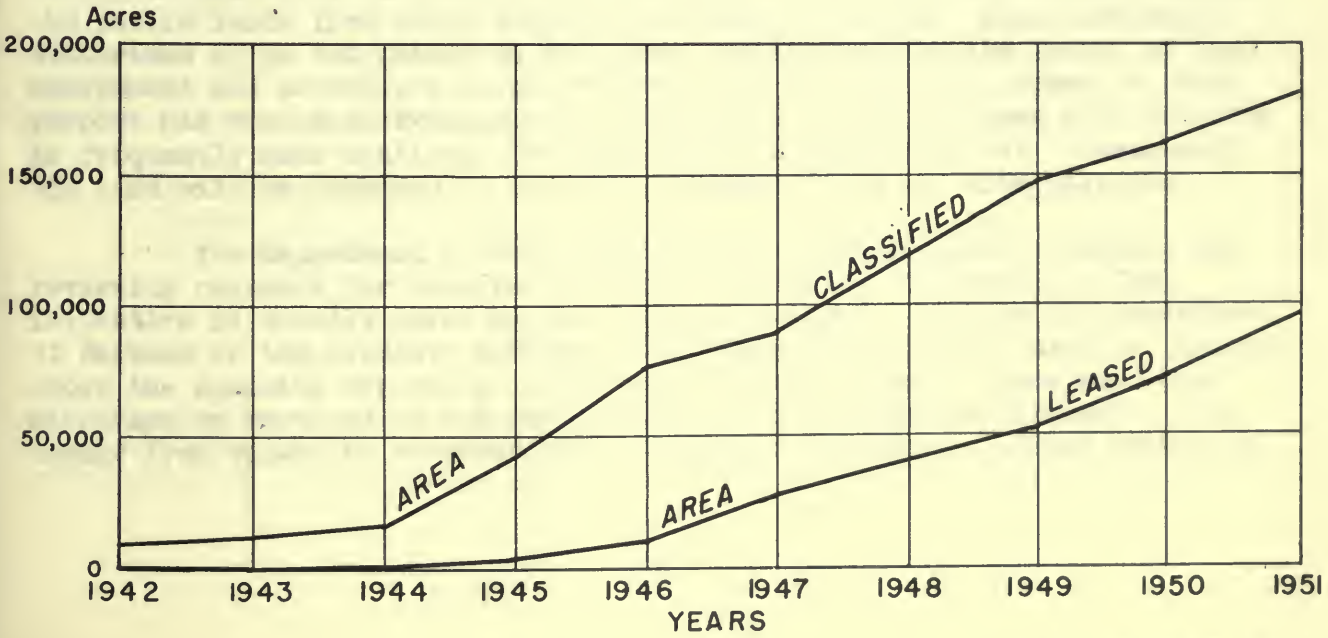


Chart BLM-W-89

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rights these withdrawals offer a problem in public land management. In Alaska a general feeling is that land suitable for development by individuals is for the most part held by some agency.

These reservations are made under different authorizations, the most important being the broad Executive authority of the President which has been confirmed by the acquiescence of both courts and Congress. This authority has been delegated to the Secretary of the Interior who until recently acted with the approval of the Bureau of the Budget and the Attorney General. The Bureau of Land Management acts on all such withdrawals. This authority is used primarily to withdraw areas for public programs and limit the uses of the public domain. Authority used to withdraw temporarily lands for power sites, irrigation, classification, and other public purposes, is contained in an act passed June 25, 1910. This act, which grants the President authority to withdraw lands for these specific purposes, has also been delegated to the Secretary of the Interior. Withdrawals are also made under a number of specific acts which limit the provisions of the withdrawals.

Authority granted to the Secretary to withdraw lands for reclamation purposes under the act of June 17, 1902, has been delegated to the Bureau of Reclamation. The Bureau of Reclamation with the concurrence of the Bureau of Land Management now is in a position to withdraw on its own initiative lands which are required for future irrigation development or for the development of resources in connection with irrigation.

Air navigation sites are withdrawn by the Bureau of Land Management. Revocations of withdrawals under these acts may be made by the agency initiating the withdrawal. However, there are withdrawals under special acts of Congress which are effective until revocation of the act itself.

Under the public land orders written in 1934 and 1935 all public land including the areas of grazing districts is withdrawn pending classification to determine its best use. However, any specific withdrawal removes the public lands from being subject to reclassification. Stock driveways authorized by an act passed in 1916, are administered by the Bureau of Land Management and probably a large proportion of the lands withdrawn for this purpose has been made available for other uses. Land in power site reserves is frequently made available for use under the condition that if necessary the land will be returned to the United States for power site purposes.

The Department of the Interior has no satisfactory procedure for reviewing requests for reservations or for revoking withdrawals. The initiative is usually taken by the interested agency, such as the Department of Defense or the separate bureaus of the Department of the Interior. Table 1 shows the agencies for which in the past two years public lands have been withdrawn or restored to the public domain from previous withdrawals. The change from vacant to reserved status and from reserved to vacant status is

an important element of public land transactions and changes the administration of large areas each year.

PROBLEMS OF MANAGING RESOURCES ON RESERVED LANDS

The management of resources such as grazing, timber, and other salable materials on these withdrawals is frequently confused by the number of agencies involved. The area may have resources other than those administered by the withdrawing agency. The withdrawing agency may not have the organization or trained personnel for managint the resources. The continuity of the program of the Bureau of Land Management will be improved considerably when the management of resources on these withdrawn lands, exclusive of national forests and other areas used for specific purposes, rests with this Bureau. It should be possible to work out management procedures with the responsible agency which permit the land to be used for the purposes for which it was withdrawn without neglecting other valuable resources on the area.

A more definite and positive program is needed to revoke withdrawals of land not used for the purposes intended or in excess of areas required for the purpose for which the withdrawal was made but as many agencies and interests are involved it promises to be one of our major problems.

ENTRIES ON LAND PRIMARILY FOR AGRICULTURAL DEVELOPMENT

Homesteads

The remaining public lands offer limited opportunities for development under the homestead laws. Because the law requires the improvement of the land for agricultural production the best opportunities are in areas developed by public agencies for irrigation farming. High prices, increasing population, and extension of our road system bring applications for homesteading on land which normally would be considered too dry, too swampy, too rough, or too poor for cultivation. The 660 final homestead entries approved in 1952 were more than double the number 5 years before (see Chart) but are only a minute fraction of the 1.4 million homestead entries allowed since 1862.

Homesteads, except in Alaska where 212 were approved last year, and on reclamation projects which accounted for 409 approvals, are not an important factor in modern public land operations. Chart 4 shows the increasing interest in land entries.

PUBLIC AUCTION SALES

Isolated tracts of public land and tracts too rough and mountainous for cultivation are sold on application to bidders when such disposition is in the public interest. The number of sales and the area sold have increased

Table 1

WITHDRAWALS AND RESTORATIONS OF PUBLIC LAND

Purpose	Land Withdrawn		Land Restored	
	1951	1950	1951	1950
	acres	acres	acres	acres
Air navigation sites	3,792	4,123	300	6,707
Atomic Energy Commission	202,835	-	23,000	-
Defense Department	1,138,918	420,742	658,635	396,388
Flood control	45	37,368	-	-
In aid of legislation	300	-	6,040	182,736
National forest admin.	35,065	9,304	-	3,688
National forest	6,291	66,675	183	1,959
National monuments	315	13,000	140,680	8,620
National parks	132,492	-	-	-
Power sites	21,295	41,929	2,400	515
Public water reserve	-	335	600	-
Reclamation	36,675	10,056	690,480	38,379
Stock driveways	160	342	3,596	7,832
Wildlife	38,881	505	6,175	8,241
Others	135,892	2,367,661	2,048,288	127,224
TOTAL	1,752,956	2,972,048	3,580,377	782,295

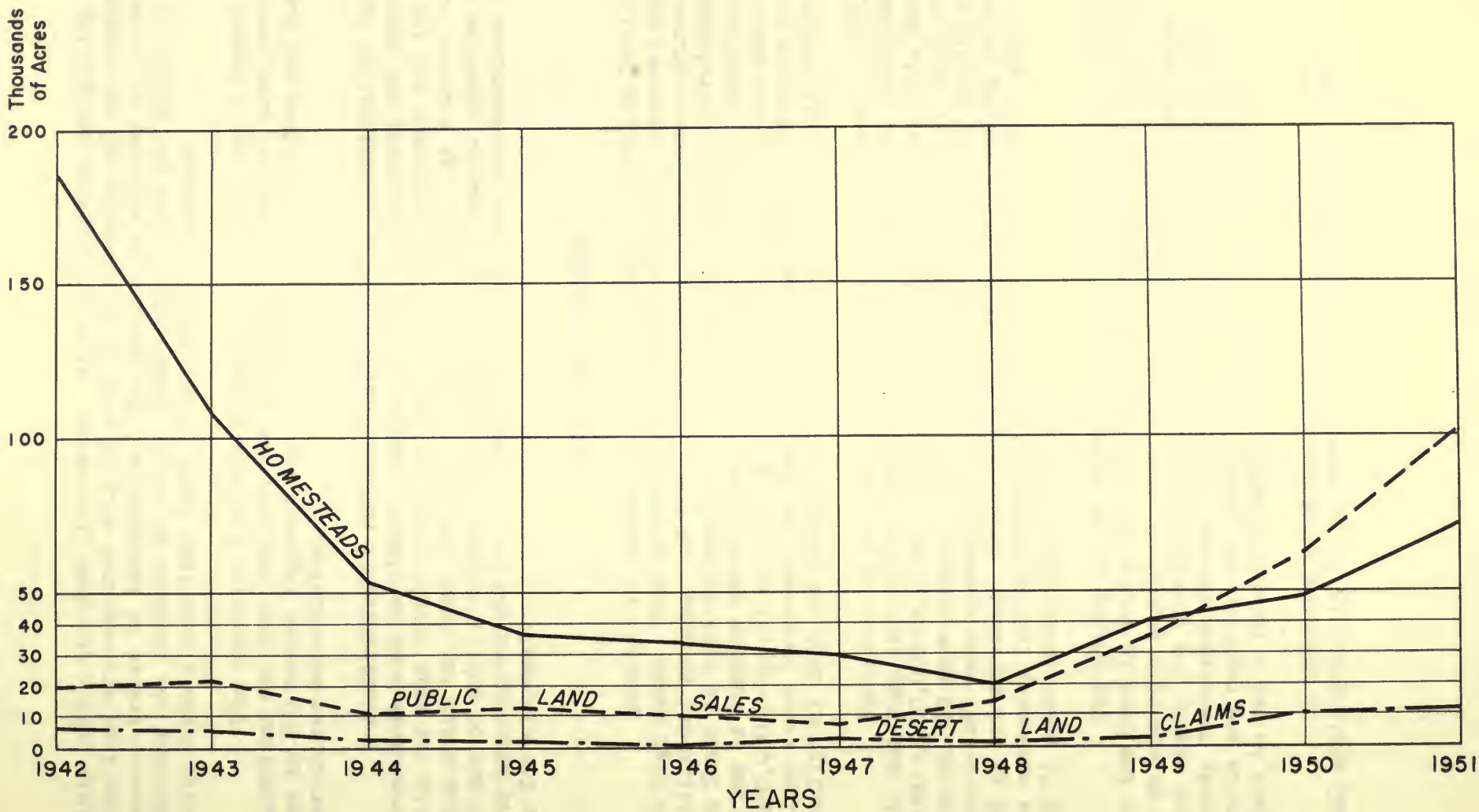
Table I

[illegible]

Agency	Land Withdrawn		Land Restored	
	[illegible]	[illegible]	[illegible]	[illegible]
	Acres	Acres	Acres	Acres
Air Navigation sites	[illegible]	[illegible]	[illegible]	[illegible]
Atomic Energy Commission	[illegible]	[illegible]	[illegible]	[illegible]
Defense Department	[illegible]	[illegible]	[illegible]	[illegible]
Flood control	[illegible]	[illegible]	[illegible]	[illegible]
Or aid of legislation	[illegible]	[illegible]	[illegible]	[illegible]
National forest admin.	[illegible]	[illegible]	[illegible]	[illegible]
National forest	[illegible]	[illegible]	[illegible]	[illegible]
National monuments	[illegible]	[illegible]	[illegible]	[illegible]
National parks	[illegible]	[illegible]	[illegible]	[illegible]
Power sites	[illegible]	[illegible]	[illegible]	[illegible]
Public water reserves	[illegible]	[illegible]	[illegible]	[illegible]
Reclamation	[illegible]	[illegible]	[illegible]	[illegible]
Stock driveways	[illegible]	[illegible]	[illegible]	[illegible]
Wildlife	[illegible]	[illegible]	[illegible]	[illegible]
Others	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]

CHART No. 4

AREA APPROVED, FINAL ENTRIES, HOMESTEAD, PUBLIC SALE AND DESERT LAND CLAIMS



rapidly during the past five years. As no cultivation nor quality standards of the land are required this is a means of disposing of our numerous scattered tracts to individuals. The protection afforded adjoining owners permitting the purchase at not to exceed three times the appraised value usually directs land into hands of established managers.

The provision has been abused by adjoining owners enough that regulations may need revision but in general the sale of more than 100,000 acres in 773 tracts improved the land pattern of the Bureau and placed land under closer supervision.

Application to purchase lands have been stimulated by the value of resources such as timber, gravel, etc. Classification and appraisal of tracts for sale should consider the value of all resources and the contribution which the tract can make to public programs. As a matter of insuring full use of public values, the interest of other Federal agencies and of State agencies should be considered before the land is determined to be suitable for disposal.

DESERT LAND ENTRIES

Interest in desert land for individual irrigation development is at a high pitch. High prices for certain commodities, improved methods of drilling and pumping, and speculative values in land have combined to bring on a flood of applications. Originally aimed to achieve development of small sources of surface water, the desert land act has a poor historical record. Of 160,000 original entries on 33 million acres of land only about 1/3 on 10 million acres progressed to the point of final entry. The area of land actually put into and remaining in production is very questionable.

Applications for desert land entry usually propose drilling of wells and pump irrigation, requiring in most locations an investment of 20,000 to 30,000 dollars. During 1951 the Bureau received 994 applications of which 910 were presented for field examination. Of the applications acted on 281 were classified as suitable for disposition and 318 were classified as not suitable. Decision on many was withheld pending procurement of data necessary for intelligent classification. Final entry was accepted on only 75 cases covering 10,600 acres.

The policy of the Bureau has been to reject these applications unless the land is suited for farming, the topography adapted to irrigation, and an adequate supply of water available at reasonable depths. Few proven areas remain for development and in most of these the known water supply is already over-appropriated. Approval of additional entries where drilling permits are required can rest upon the ability of the applicant to obtain a permit to use a volume of water adequate to develop his area.

In untested areas the classification problem is not easy. The usual application is for an area which would have at best only a limited

supply of water and if applications are approved the number should be limited by the supply of water. Declining water levels in most of the pump irrigation areas can be disastrous to established farming units.

Chart 5 from a U.S.G.S. report on underground water illustrates the necessity for a balance between water use and water recharge. The recharge may be from precipitation within a limited area, typical of most basins in the Western States, or the recharge may be from surface stream sources. The underground storage area may be small or large, but in the desert areas it almost surely is less than the usable surface area. Each aquifer presents an individual problem as to source of water and rates of recharge. Lacking trained hydrologists, the Bureau of Land Management depends upon the ground water branch of the water resources division of the Geological Survey for expert opinion on quantity and quality of water.

A recent report "The Drought in the Southwestern States" gives as its first recommendation that "all state and local agencies * * * take action to establish controls over ground water development and withdrawals * * *" In view of the critical situation of many of the areas from which applications are received, indiscriminate approval of desert land applications would prove costly to applicants and would endanger established farming areas.

Underground water is a resource that must be carefully used even in those basins with no apparent connection with developed areas. Over exploitation can result in reduced water tables, increased difficulty of supplying water to livestock, and loss of investment to prospectors.

VACANT PUBLIC LANDS IN THE U. S.

The past five years has shown a decided increase in the demands on the remaining public domain. Applications for the use of land under all public land laws have increased. Individuals and agencies are recognizing values in the areas passed over in the great settlement movements, and periods of land reservation of the past. As pressures grow stronger the Bureau of Land Management must develop techniques to better determine the best use of the lands and the type of management that will get the most from its resources.

From 474 million acres 50 years ago the area of public land open to entry has shrunk to 170 million acres. But that area plus the public lands in Alaska offers problems enough to keep us thinking for a long time.

Vacant Public Lands 1904 to Present

Year	Million acres
1950	170
1945	170
1941	172
1930	179
1920	200
1915	280
1910	344
1904	474

CHART No. 5

DIAGRAMMATIC SECTION SHOWING OCCURRENCE OF GROUND WATER
ANTELOPE VALLEY
CALIFORNIA

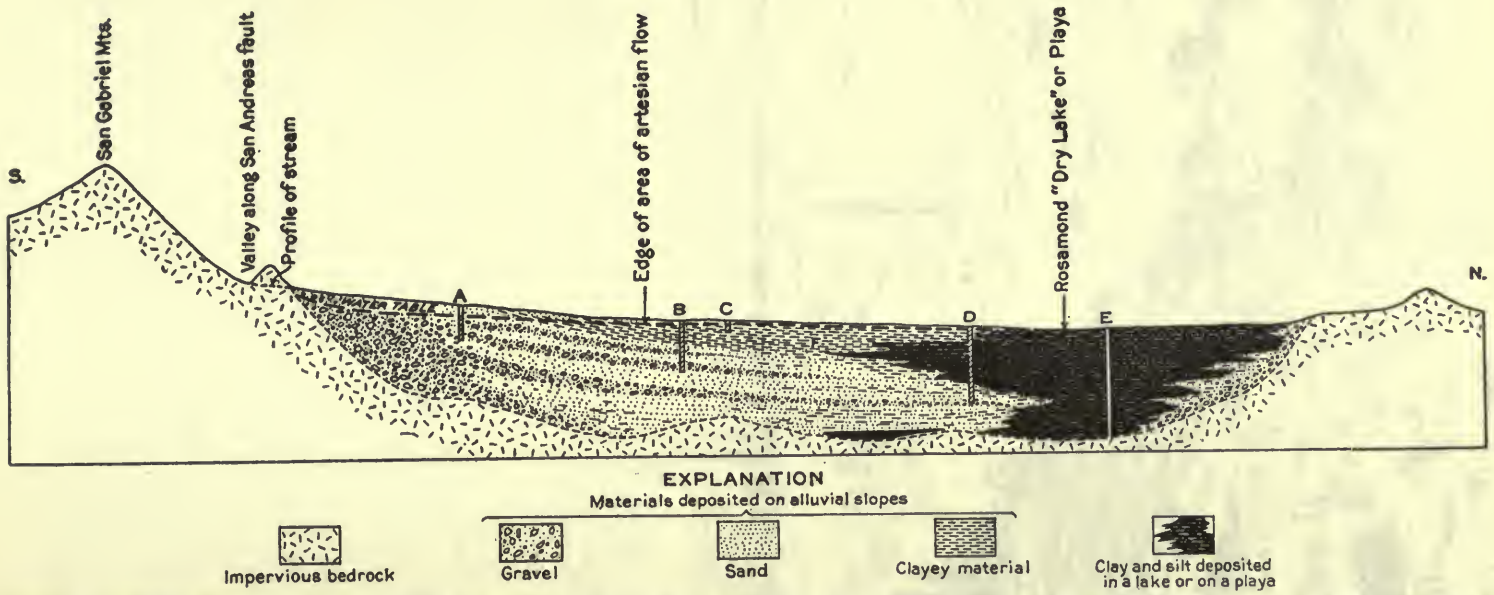


FIGURE 11.—Diagrammatic section across Antelope Valley from south to north, showing occurrence of ground water. Heavy dashed line is water table. The bed of clayey material, F, is relatively impervious and holds the water beneath it under pressure. A is an ordinary pump well. B is a flowing well near the edge of the area of artesian flow, penetrating gravel below the playa clay. C is a shallow well in the area of artesian flow, but it will not flow because it does not reach a water-bearing bed below F. D is a flowing well that obtains its supply from a deep gravel bed. E is a dry hole, drilled to bedrock entirely through silt and clay too impervious to yield any water

Reprint from Geological Survey
Water-Supply Paper 578

Bureau of Land Management

32120

OPTICOMBIT
PRACTICAL OPTICS
CHROMATOPHOTIC DEVICE SHOWING OCCURRENCE OF COLOURS MIXED
CARD NO. 4

CHART No. 6

Our Public Lands have many uses.

Some of the uses of these lands are illustrated by Chart 6.

CONCLUSIONS

1. The vacant public land area of the United States has been reduced through transfer to private ownership and reservations for special public purposes from 1.4 billion acres to about 170 million acres. Even this area is subject to appropriation only after classification to determine its suitability for the intended uses.

   After years of selection under unrestricted appropriation the remaining areas include little land suited for development under the homestead and desert land laws.

2. The increasing population of the United States and the development of its resources, particularly in the West, adds to the value of the public land and its resources. The demand for public lands for all uses increases.

3. Protection, use, and improvement of the resources justifies greater expenditures of time and funds but stability of tenure is essential to any improvement program.

4. Application for the use of the lands by Federal and state agencies raises questions as to (a) the returns to the public from the exclusive use of one or all resources, and (b) the administration of secondary uses on the lands.

   Management of these resources is an important bureau function.

5. Improvement of the land pattern will facilitate management of both public and private lands. A plan for an adjustment of holdings should consider all uses and include interests of all agencies.

6. To act on land applications we need a definite but flexible program based on area studies. This program should include:

   a. Withdrawals for Federal agencies:
      reclamation, parks, wildlife, defense, atomic energy, water resource development, watersheds, forests, flood control.

   b. Applications for state administration:
      recreation, wildlife.

   c. Applications of States for lieu lands.

   d. Applications for private ownership:
      homesteads, desert land claims, public sales, small tract sales.

   e. Lease or sale of resources:
      grazing, timber, minerals.

7. An effective public land program needs:

   a. For making decisions, a comprehensive study of resources so that decisions regarding tracts will be influenced by the effects on the administration as a whole. Resource inventories, area studies, and basin studies can be used for such programming.

   b. Some coordination of land laws; and

   c. Funds for administration.

(Reprinted in U. S. A. from *Transactions* of 1944
of the American Geophysical Union)

EVENING GENERAL ASSEMBLY
JUNE 2, 1944

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DOWN TO EARTH

Walter C. Lowdermilk

For seventy centuries of civilization, which is man's own show and venture into the unknown, mankind has sought a more abundant life on this planet, but with more of failure than of success. This holocaust of war leads to the conclusion that civilization has been weighed in the balance and found wanting. Now we are fighting to the death for another chance. It is not my purpose to discuss the abstract motives of good and evil that may inspire man's actions, but, rather, to bring our thinking down to Earth.

For more than 20 years my profession has been to read the records which farmers, nations, and civilizations have written in the land. My chief interest in these studies in land use is to find the basis for a lasting adjustment of human populations to the Earth.

These travels have taken me across six of the seven seas to study land use in 26 countries in four continents. I have also had a bird's-eye view of 11 other countries in aerial flights to and from China. Surveys of land use have taken me into those regions where civilizations first arose in the Near East and in the Far East.

What do we find? The cradles of civilizations are in decline; ruins of great works bespeak former wealth and splendor amidst modern decadence and poverty. Evolution of civilization appears to have gone in reverse. For it is chiefly in the newer lands, occupied in comparatively recent times, that people enjoy a greater abundance. This is an arresting tragedy. As I have looked upon ruins of old lands and depressing poverty and backwardness of their peoples, I was deeply moved by the wastefulness and ineffable sadness of man's failure to adjust himself to the bountifulness of the good Earth.

In ignorance and wastefulness, mankind has strode across the face of the Earth for 7,000 years reaping where he has not planted and destroying what he has not made. In occupying new lands man skimmed off the "cream" and left "thin milk" for the generations to come. Man tends to destroy the source of his existence.

The children of men found the Earth literally a "Garden of Eden." But after 7,000 years of increasing command of tools and machines, civilization is on trial for its wastefulness of land. Thus far, we have no guarantee that civilization will long endure. On the basis of past performance, the prospect for the future is that mankind will mine out the Earth's resources and productivity from place to place, leaving desolation as of abandoned mines of our west, until the habitable parts of the Earth have been exploited and laid waste. Suicide of civilization seems to be the end of this march of ruthless exploitation, rather than a more abundant life for people.

If civilization is to endure, society must be born again out of an economy of exploitation into an economy of conservation. "Where there is no vision the people perish."

Though past failures are more common than successes, there is yet hope and yet time, as we appraise the possibilities of this old Earth in its stored resources and regenerative powers derived from the energy of the Sun. If we find the facts and understand and make full use of energies and forces that stand at our service on every side, we may still have a more abundant life for all people.

We have in the will to survive, motive power enough to make civilization a success if the means are known and understood. I shall leave to others the discussion of how motive powers of a people may be stimulated and directed, and confine myself to an examination of certain geophysical controls that condition any type of civilization whatever its motivation. The law of gravitation is not subject to a decree of the court nor is the force of running water modified by popular vote. "They build the house in vain except the Lord build it" was said by a seer of long ago. We build a civilization in vain unless it is backed by the laws of the universe.

First it is well to take stock of this planet as a dwelling place of mankind, as well as man's stewardship of it. After all, man is a newcomer and sojourner. The Earth was already old in a display of manifold phenomena of terrestrial forces before the first hunter and the first farmer

Fig. 1--Volcanologists are supplied with more and new data on volcanoes in the eruption of Parícutin in Mexico in August 1943--a reminder of the "ring of fire" around the Pacific (Courtesy Science Service)

ever sought out food for his family and himself. The sea was filled with waters; rains descended and floods came and went; continents were uplifted and worn away again and again by geologic erosion of streams and winds; and the debris was sorted and spread out in great sedimentary deposits and compressed into rock-strata; countless volcanoes had burst forth in landscapes where there was no man to see or to hear; lava had poured forth in great fiery lakes without a human spectator. The sea advanced and receded. Vegetation in many forms had spread over land in mild and moist climates, and under its protection, fertile soils were formed; beasts of the field, birds of the air, and fishes of the deep evolved, flourished, and by some failure of adjustment to environment became extinct. Whether or how soon man also may go the way of the dinosaur or project himself into the distant future, will depend on how well he works out adjustments of civilization to the good Earth.

The Earth is the silent partner in the rise and fall of peoples and civilizations. It richly rewards the diligent and understanding. It brings a curse of poverty and decadence upon those who

Fig. 2--In the silence of death stand excavated ruins of a former prosperous and beautiful ancient Roman city, Timgad, of Algeria, North Africa. Change of climate since Roman times is not the cause of this desolation, but misuse of the good earth.

Fig. 3--A portion of the market square of Cuicul, long dead and buried, as disclosed by archaeological excavations. Now slopes once covered with olive orchards and vineyards are grazed into the ground and are eroding more and more. Such is a monument to misuse of land rather than to adverse change of climate.

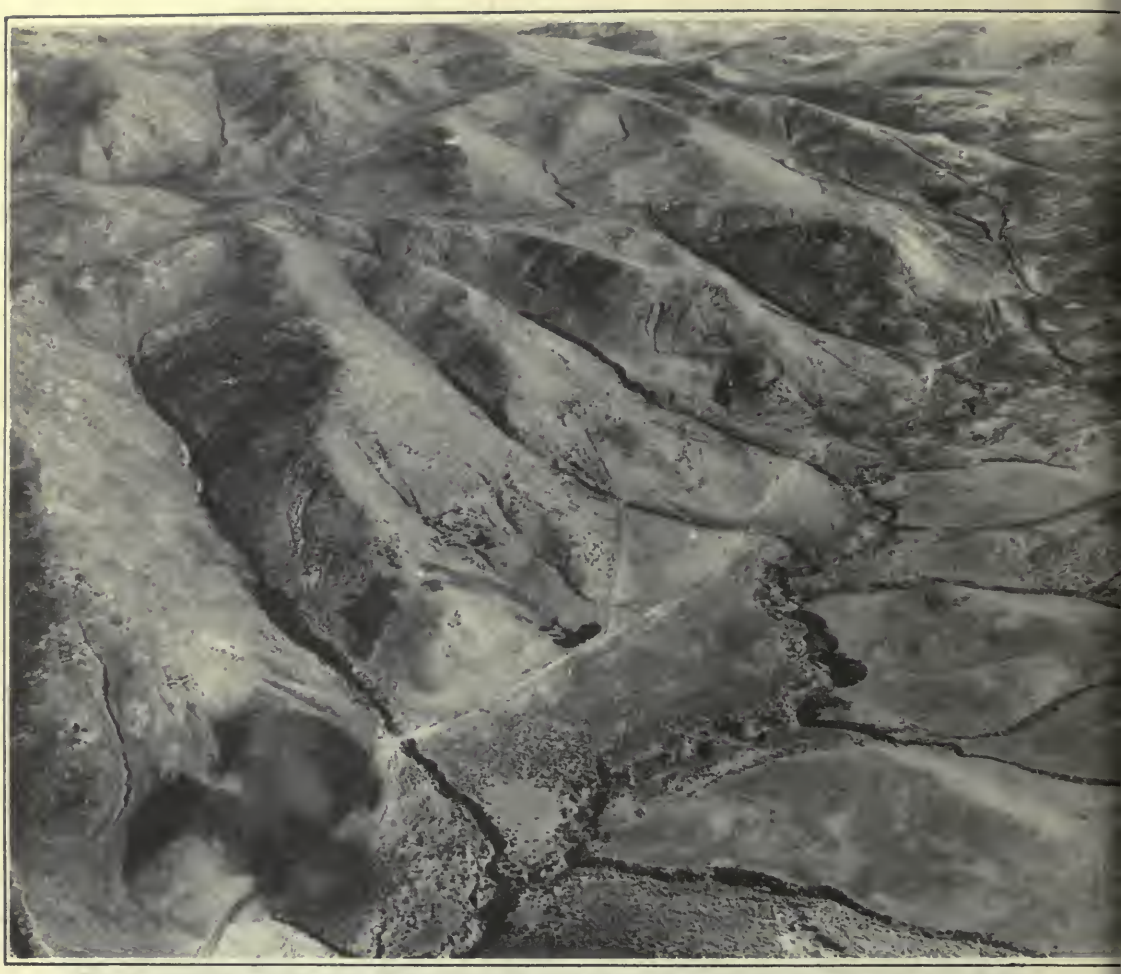

Fig. 4--Normal sculpturing of a landscape may be accelerated by clearing off the natural protecting cover of vegetation, as has been done by heavy and overgrazing in this Idaho landscape. Bare land absorbs downpour of rain less rapidly than before; surficial run-off is increased. Flashy storm-flows cut deeper than before the valley-floors into gullies and arroyos. Lowered base-levels further increase runoff-velocities, cutting and carrying power of storm-runoff in geometric ratios. Erosion of this landscape is accelerated above the geologic norm of erosion of the area with consequences unfavorable to human welfare.

neglect and waste its substance. An ancient Law Giver said, "The sins of the father shall be visited upon the children to the third and fourth generations." But in the wastage of the Earth's resources, sins of exploitation and wastage are visited upon the children for ten times three and four generations to come.

For, in the last reckoning, all things are purchased with food. Such is the fateful and awful truth that hideous famines make known. World-wide war, that today is strangling civilization, also shows up the enormity of this fact. People sell their liberty, their all for food when driven to extremes of this tragic choice. When food fails, all else fails--civilization falls apart. There is no substitute for food.

Moreover, our civilization is bought with food, our cultural advantages and satisfactions, our advance in science, our industrial achievements as a Nation, and now our war effort. Food, abundant and adequate, is necessary for victory. The flag is on the plow as well as on the battleship and on the factory. This partnership of land and farmer is the rock foundation of our complex social structure, which provides high standards of living, cultural, and recreational facilities.

Fig. 5--A long story is recorded in this aerial view of the Piedmont, South Carolina. Before clearing and cultivation, this area was covered with dense climax forests of oak and hickory. But all this area has been cleared and cultivated. Under 40 inches of rainfall soils on rolling fields eroded until crop-yields no longer would justify costs of labor and seed. Such fields were abandoned and grew up first to broom-sedge, into which volunteer seedlings of pine came. In time, pine-stands grew on abandoned farm fields. All these stages may be seen in this fascinating view from the air.

"Man shall not live by bread alone." But he must have bread to live and to take part in other advantages.

It was in Egypt while contemplating the Pyramids and long use of land in the Nile Valley that I grasped more fully the basic relations of civilization to the land. About 6,000 years ago, a genius of a farmer hitched an ox to a hoe and invented the plow, and for the first time applied power in agriculture. This made the farmer more efficient in growing food. More than he needed for his family and himself released some of his fellows for other tasks. Greater farmer efficiency led to divisions of labor that gave rise in time to a complex civilization of higher standards of living. As I imagined unrest of unemployment brought on by this first increase in farmer efficiency, I suspected that the great pyramids of Egypt were the first great Work Projects Administration projects.

Maximum production is the goal. Land is the silent partner of tillers of soil in this exacting and vital task. But the land may be damaged or destroyed by wasteful cultivation and misuse. We have examples in the new land of America, where in a comparatively short period of occupation in the United States alone an area larger than Kansas has been ruined for further cultivation and now fully 200 million acres are eroding faster than soil is being formed. The present National soil-conservation program, which farmers of more than three-fourths of the total farm-area of the

Nation have joined in soil-conservation districts, has only made a beginning in this great task. This is the first time in human history that a Nation as a whole has taken thought and action to combat this evil of civilization that destroys productivity of lands as need of them grows.

The world is today more fully occupied and populated by the human race than ever before. All lands have been possessed by nations. No free land remains. Mankind is left to work out its salvation on lands now occupied. Of the total area of the Earth, about 3,054 million acres are reported under cultivation and support the present world population of about two billion souls. On the average, 1.5 acres grow the crops for one person. This population is increasing rapidly. Since 1800 the world population has increased from 604 million to 2,000 million, or threefold in about 150 years. All land suitable for cultivation is estimated at about 3,714 million acres, or one-tenth of total land-area. Most of the unbroken area of possible cultivation lies in the tropics with its serious drawbacks. All the best land in the most habitable parts of the world is already under cultivation. A vast area has been ruined for further cultivation and much of it is being depleted by misuse and soil-erosion that lessens prospects of the food supply in the face of an enlarging population with its increasing demands.

In the face of the limited area now available to the human race, the idea that man is still destroying its usefulness by inconsiderate and wasteful methods should shock all thinking people into action. If man is making deserts out of productive lands it is a matter not only of National but of world-wide concern. It is an international tragedy. If a Nation would project itself into the future, it must protect its lands from the ravages of soil-erosion. When lands are impoverished, peoples lower their standards and suffer privations both physically and spiritually. Soil-erosion is a deficiency-disease of the land which begets deficiency of food, vitality, and higher values for peoples and nations.

Land, therefore, is not an economic commodity but an integral part of a Nation, even as its people are. Man expresses his moral obligation to posterity as surely through the Earth as through his social institutions. Fertile or sterile lands that are passed on to feed future generations are, apart from blood descendants, our most direct link with the future. When the Earth's resources are wholly husbanded in the advanced knowledge of full conservation, the possibilities of the Earth for increased populations are far beyond the imagination of mankind in general. If the vast energies of the human race and resources of the Earth could be directed toward a goal of conservation instead of destruction and despoliation, the good Earth would respond with abundance for all.

Only by conservation in the fullest sense, of the basic resources of land, water, and the spirit of peoples, can we maintain the human values of wholesome standards of living, opportunity, freedom, justice, and faith in the destiny of our civilization. Only in conservation have we the assurance of continued progress in the search for that something which has led humanity out of the stone age into an industrial age in which powered machinery increases efficiency of all divisions of labor. Only by conservation can we be led on to a higher economic, physical, and spiritual development which expresses itself in stewardship of the Earth for the well-being of the individual, the State, and the survival of civilization.

This working out of a lasting adjustment of people to the Earth calls for the application of a wide range of earth-sciences as well as biological. The need to provide for the enlarging technology of today calls for more and more facts about the Earth and the universe.

Such is the province of the American Geophysical Union. The American Geophysical Union is commissioned to "promote the study of problems of the figure and physics of the Earth, to initiate and coordinate researches on natural phenomena of earth-processes and interpretations and applications to human welfare." Such action depends on National and International cooperation and scientific discussion and publication. These duties are organized under eight sections of the Union: Oceanography, Terrestrial Magnetism and Electricity, Seismology, Volcanology, Tectonophysics, Meteorology, Geodesy, and Hydrology. These embrace fields of knowledge of physical phenomena necessary to the working out of a lasting adjustment of mankind to the Earth. Not only is this knowledge of immediate use in supplying material needs but is of highest value to satisfactions and noble pleasures of mind and spirit in understanding and contemplation of the wonders of the Earth and of the universe.

In the course of my travels, I have seen many of these great earth-forces in action and their effects. This evening, I wish to share with you some of these experiences in seeing wonders that are sufficient to excite scientific curiosity for centuries to come. Especially was this true on my recent trip to China and return, in which I sailed the seas for 60 days and flew the full length and breadth of Africa and across India into China.

Fig. 6--From the air, one sees how, near Dadeville, Alabama, rolling lands of the Piedmont have suffered serious damage from unwise use of land. Hundreds of new drainage-channels show how unabsorbed waters from heavy rains are washing away soil and guttering hillsides to change the regime of waters and to lower capacity of the land to grow crops.

Fig. 7--Down to Earth in the fair land of America. Misuse of the good earth here has destroyed land for any further cultivation and calls for costly measures of restoration to crops of lesser value in trees. Such misuse of land will not long support a prosperous civilization.

Fig. 8--Dynamics of land-shaping processes in action! In the hydrologic cycle, the circulation of water in rain-runoff and stream-flow has been the major agent in sculpturing landscapes and in generating crustal movements by accumulations of the products of erosion in vast sedimentary deposits. Here clearing land of its original protective cover of vegetation for field-crops has accelerated processes of earth-sculpture to rates that undermine the welfare of farmer, community, and Nation, and, indeed, of civilization, and calls for measures of land-use that hold in leash the dynamic action of geophysical processes.

This and former sailings give me a high respect for the science of oceanography. Of all the deserts I have traveled, the ocean is the most lonely and desolate, merciless, and majestic. Its restless currents, winds, and waves have played a vital part in the evolution of civilization, and will continue to do so. The ocean was particularly forced upon me on my trip to China in 1942, when military considerations required our ship to change its course to go through the Panama Canal, which sailors call the big "ditch," and down the full length of South America and around the Horn through Antarctic waters and south of the Falkland Islands to South Africa. For 45 days we saw no land except for a glimpse of Cape Horn. How immense, how vast are the waters of the ocean!

We passed through the Caribbean Sea, where are brewed the hurricanes that sweep the South Atlantic States. A wonderful display of cumulous clouds was boiling up from a steaming sea into a vast dome, beneath which the visible sea was like a bowl filled to the brim. The circle of the horizon moved with our ship as WILL ROGERS' spinning loop used to follow him across the stage.

As we crossed the equator off Ecuador, the weather suddenly changed from steaming heat to chilly winds that forced us into warmer clothing. The Peruvian Current from the Antarctic brought cold waters to the tropics off South America. We left behind the Dipper, and under the

spell of the Southern Cross we entered the "Roaring forties," so called by sailors of the Seven Seas. Our ship rolled and pitched on waves like moving hills that bore down on us and burst into plumes of spray that scattered before the wind like dust over the sea. After the first storm, I wrote my wife that I knew I had thrown up everything but my appointment to China. After that, in other storms I was a fascinated onlooker from the bridge.

The ocean in a storm is an awesome thing. Our little ship, though loaded heavily with bombs, bobbed and tipped far to the right and the left like a log as great masses of writhing monstrous waves struck her time and time again. So has the sea tossed up its angry arms for millions of years, but little comes of it until waves strike the land and wear it away.

Life above that southern sea amazed me. The albatrosses, great bomber-like birds, adopted our ship and wheeled in great figure eights about the ship day after day. Cape Horn pigeons also followed after. They are the most perfect flying machines I have ever seen. Their mastery of turbulent air-currents was a daily source of wonder and admiration and should be studied with slow-motion moving pictures.

The ocean, which covers 70.8 per cent of the Earth's surface, with its life, its mineral salts of prodigious quantities, its storms and winds, its currents bringing warmth to cold areas or cooling winds to hot lands, calls for full play of scientific imagination and profound investigations fully to understand its mysteries and to make use of garnered facts for the benefit of mankind in his search for security in an abundant life.

Flying along the east coast of Africa to Mombasa, thence overland to Lake Victoria and down the full length of the Nile to Cairo and on, gave me a bird's-eye view of evidences of many past and present workings of Earth forces.

As we neared Mombasa on the coast, our pilot maneuvered the giant flying-boat to avoid a thunder-storm that filled the sky in the west. Vivid flashes of lightning illuminated the vast boiling storm-cloud. It was a grand sight. Natural electricity was being generated to enormous voltages. Here was a majestic show of earth-electricity that has in lightning and its thunder struck awe in the minds of man for unknown ages. After so long a time we are only beginning to gather facts for understanding these phenomena, such as the accumulation of electrical static charges within clouds.

This spectacle suggested the field of Terrestrial Magnetism and Electricity, which is the study of magnetic and electrical phenomena of the Earth's interior, surface, and atmosphere. The Earth is like a great armature spinning in space, generating a magnetic field, to which man is insensible. But instruments are now so perfected as to make use of these forces for many purposes, some of which are well guarded military secrets.

Recent developments advance our knowledge of cosmic radiation and relations of electrical and magnetic conditions to solar phenomena. Radio communication is advanced by results of researches in this phase of earth-forces. Location of geological structures and ore-deposits is also facilitated by magnetic studies. In the larger problem of adjusting civilization to the Earth, the field of terrestrial magnetism and electricity contributes to efficiency in communication and information of the people as was little dreamed of in the past. It serves to make the whole world a neighborhood.

I have seen many evidences of faulting of the Earth's crust that set up earth-waves as studied in the field of seismology. Flying from South Africa to Suez, just east of Lake Victoria on the equator, I had a bird's-eye view of the great Gregory Rift, which is a part of the much-faulted region of Central Africa. This earth-fracture reached from horizon to horizon to the north and south. The land to the west had dropped down 3,000 feet or more, leaving a great cliff standing, bold and naked. At its base were great blocks of the Earth's crust all awry, with edges fresh and scarcely weathered, as if this great rift took place only a few months ago. The Earth's forces had a field-day here. This escarpment is in the roof of Africa that seems to have fallen in over a great area and may be related to the great Jordan Valley Rift to the north.

Our great hydroplane dropped down on the smooth surface of Lake Victoria in a sunny calm and cool evening. The lake reflected the western Sun on a vast surface bounded by indented shoreline and broken by many islands along the shore. Victoria on the equator lies at four thousand odd feet elevation and is the largest of a group of five great lakes that owe their origin to the rift-faults in the roof of Africa. Here also the four great rivers of Africa have their source: To the north, the great Nile; to the east, the Ruaha; to the south, the Zambesi, that then turns east into the

Indian Ocean; and to the west, the great Congo. Lake Victoria has an area of 26,800 square miles--between that of Lake Michigan and Lake Superior. Vegetation about Lake Victoria was luxuriant, showing ample rainfall. Much of the lowlands was cleared and cultivated to small farms, exposing bright red soils. But sloping fields showed tell-tale gullies of soil-erosion on the equator.

In the rosy dawn of the next day, the mighty engines pulled us off the glassy surface of Lake Victoria, and our pilot turned to the northward. But on the way he gave us a great show by flying very low over the Uganda Game Reserve, where the roar of our motors flightened many herds of wild elephants--in all 96 according to my tally. Next he flew us from Lake Albert up the Victoria Nile, with its hundreds of hippopotamuses, too many to tally, and then over the beautiful Murchison Falls. Thence we turned due north over the great marshy region of the White Nile and on over vast brown expanse of the Sudan. Waters of the Upper Nile were running clear. The drainage-area is well clothed with vegetation.

We stopped for the night at Khartoum, an ancient and strategic location, where the Blue Nile, draining igneous rock mountains of Abyssinia, joins the White Nile. From Khartoum to Cairo the following day we passed in our flying boat over the driest desert I have ever seen. For hundreds of miles I could not make out a bush, or evidence of any living thing except in the entrenched alluvial valley of the Nile as we crossed it. The landscape was naked, showing erosion in the raw; it was more like the surface of the Moon than anything else. Here, indeed, is a region of high interest to climatologists, for it represents an end-point of the range of climatic controls.

The landscape was worn down to near level, a peneplain in which a new cycle of erosion had only recently begun, in geologic time, cutting to a new base-level 100 to 300 feet below the former level, which may well date back to Pleistocene times. Sand-dunes in beautiful crescents spread wide over parts of the landscape. Blackish wind-swept areas with sand-filled drainage-channels made a fantastic sight. Here wind, heat, and cold held full sway.

In this vast lifeless desert flows the great Nile in a comparatively narrow entrenched flood-plain of rich well-watered alluvium. These fertile lands teem with crops and villages. As I looked down upon this fascinating scene from far above, methought how man with all his boasting is a child of the Earth, dependent on favorable combination of natural materials and forces.

The best known and most remarkable rift or trough-fault in the world is that of the Jordan Valley. A narrow strip of the Earth's crust from the mountains of Turkey southward to the Gulf of Aqaba of the Red Sea is faulted down like a trough. The deepest part is in the Dead Sea depression, where the rift valley-floor has slipped down from the high rim of Trans-Jordania over 7,500 feet and to 2,600 feet below sea-level. This depression is partly filled with brine of the Dead Sea up to a level still 1,300 feet below sea-level. The Dead Sea acts as a great evaporation-pan lying in a furnace-like valley from which water to a depth of 7 to 17 feet is evaporated each year. In a survey flight in 1939 over this unique region, I saw from the plane the physical relief of the Holy Land all laid out below me--Highlands of Mt. Hermon to the north, the Sea of Galilee, and Jordan Valley as a great trench leading to the Dead Sea deeply sunk below sea-level, and the Mediterranean shores to the west only 25 miles from this great gash in the Earth. Here natural forces had combined to set the stage for a great irrigation-and-power project, to coordinate full possibilities of all physical features and natural forces on the order of the Tennessee Valley Authority. I have proposed this Jordan Valley Authority as a means of putting natural features of this unique region to full use, to take out all sweet waters of the Jordan River for irrigation of more than a half million acres of dry lands, and to lead in Mediterranean salt-water through a canal and tunnel into the rift-valley to develop hydroelectric power up to one billion kilowatt-hours per annum for industry. The sea-waters are to be exhausted in the Dead Sea and evaporated. The salt sea-water will only add to the rich store of minerals in the Dead Sea, such as magnesium, potassium, bromine, and salt. By raising the level of the Dead Sea nearly a hundred feet, evaporation-surface is increased 20 per cent to 260,000 acres. From present incomplete measurements, annual evaporation is tentatively accepted at ten feet. That would permit the bringing in of about 2,600,000 acre-feet of sea-water per year for generating electrical power through a fall of 1,200 feet.

Such a project is a concrete example of how a full coordinated use of raw materials and natural features and forces of the Earth may contribute to the adjustment of mankind to this old Earth that is full of wonders to perform.

Earth-movements give rise to earthquakes round the world. In the great loess highlands of Northwest China, slippage of long slopes started by earthquakes buried thousands of people in their loess cave-homes in 1921. I examined a land-slip of a year ago that in an earthquake had pushed

across and dammed the Yellow River at Kong Ho. A village of 270 persons was buried without trace.

These terrifying earth-movements are beyond control but we can interpret them and sometimes anticipate them, and map the faults in the Earth's crust where more earth-movements are likely to take place and locate towns and design buildings to withstand earth-vibrations. The Imperial Hotel in Tokyo was designed by an American architect against earthquake-shocks and survived the great Tokyo earthquake of 1923 without damage.

The most remarkable seismographic charts I have ever seen are those caused by typhoons of the Pacific as recorded at the Zi-Ka-Wei Observatory near Shanghai. Father GHERZI showed me charts of crustal vibrations set up by typhoons moving toward the China Coast that were detected as far as 600 miles at sea. At that time Father GHERZI theorized thus: That pulsations within low-pressure centers of violent typhoons developed a pumping action in sea-water that was transmitted to the Earth's crust and were recorded on the micro-seismographs. As soon as centers of typhoons passed to the land, vibrations stopped, for possibly the land-surface was too rigid to be affected by barometric pulsations.

Seismology is concerned with the transmission of vibrations through the Earth that reveal structure and density-layers within the Earth. Geophysical explorations make use of these facts for locating mineral resources. Seismology will, moreover, play a still wider role in the future in locating and designing buildings and structures such as dams and engineering works.

Throughout this flight over Egypt, Palestine, and Syria, I had a bird's-eye view of many dead volcanoes that bespeak much volcanic activity in the past. Volcanology is a science of the study of volcanic and intrusive rocks, the relation of ore-deposits to igneous activity, and description and classification of volcanoes. A volcanic eruption still is the ideal news-story; it is dramatic, tragic in part, and beneficent in part. Volcanic ashes may obliterate a city as I saw in the excavations of Pompeii, but in time they make such fertile soils that farmers push cultivation into danger-zones of possible eruptions as on the slopes of Vesuvius.

We saw Stamboli at night, pouring a river of red and molten rock from the bowels of the Earth down the mountainside into the sea, causing a fog of steam so dense that our fog-horn sounded for two hours. On Christmas Day of 1938 we struggled up through deep snow to the top of Mt. Vesuvius, over 200 acres of the lava that had been disgorged only a few days before and to the coughing cone from whose base red-hot lava was pouring forth. This jagged mass of lava was still so hot that it burned off soles of our rubbers and dried out our clothes, wet with snow, in a few minutes. During a week, Vesuvius had built a new 350-foot cone as every few minutes the mountain rumbled and trembled and with a noisy belch tossed tons of rock into the air that finally rolled down the cone out toward us. Out of a fissure near the base of the cone, earth-pressures were squeezing a steady flow of tons of red-hot liquid rock from deep inside the Earth. The glowing menacing flow of lava was a hellish thing as it hissed and steamed toward us. The air was stifling with sulfureous fumes so that a member of our party remarked: "Vesuvius must not feel very good; it has terrible halitosis after having thrown up 200 acres of lava."

The recent eruption of Parícutin in Mexico (see Fig. 1), that started in a farm-field, has given the world a great show and quickened scientific curiosity. This volcano reminds us of the ring of fire around the Pacific. Such phenomena yield data of value in several fields.

The field of tectonophysics is the eighth section of the American Geophysical Union to be formed, to meet the need for coordinating data from seismographs, geological structure, and experimental pressures for solution of problems of earth-structure. Strange as it may seem, the laws of melting rock under great earth-pressures and the piercing of armor plate by high-velocity projectiles are enough alike to bring tectonophysics also into secret service for war.

The three fields of geodesy, meteorology, and hydrology include information of more direct application in the major task to work out a lasting adjustment of mankind to Earth's resources and natural forces.

Geodesy gives us the foundations for mapping: Large-scale triangulations; lines of precise leveling; and gravimetric determinations. From these data we get the base-maps and compute the size, shape, and features of the Earth. Aerial mapping is a recent development of highest importance in the use of these base-controls. Practically all projects for making use of land, waters, and resources of the Earth call for accurate maps. Geodesy serves these purposes directly and in many ways.

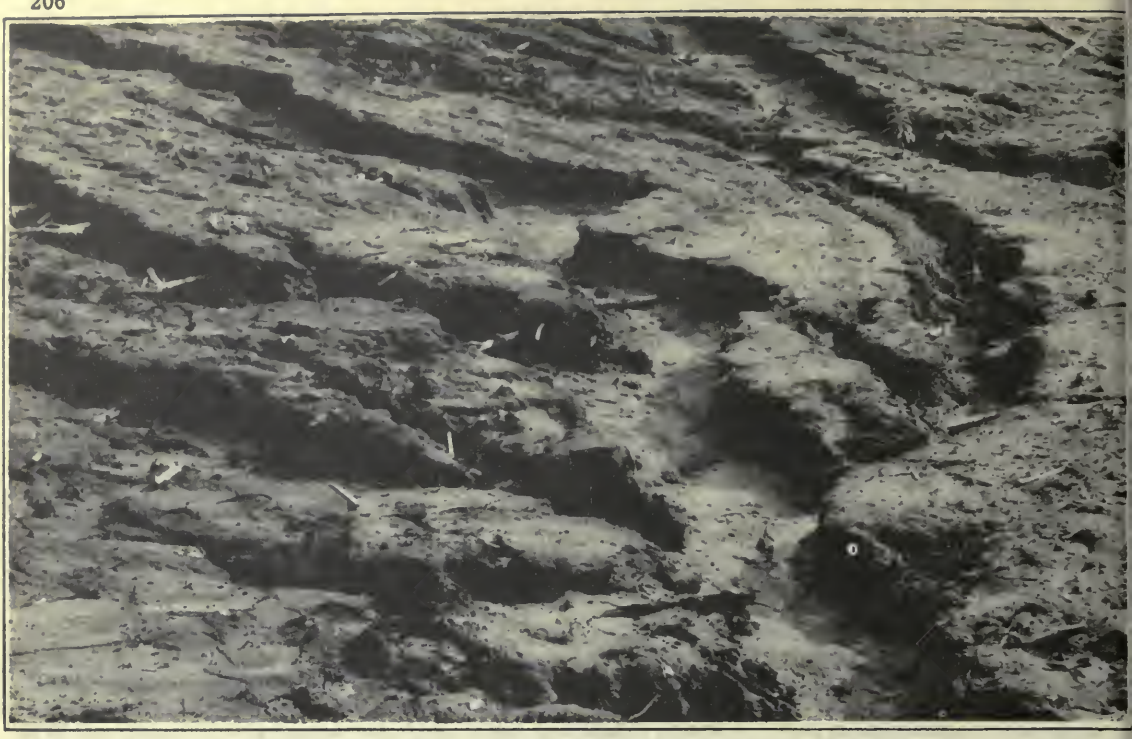

Fig. 9--A close-up of rill-erosion that removes soil with each heavy rain faster than soil is formed. This means destruction of soil unless erosion is controlled. The next plowing blots out such rills and removes tell-tale evidence of soil-wastage, for a time only. Rilling is followed by gullying that in time unfits fields for cultivation, to say nothing of depleting fertility of soil.

Fig. 10--A vital record is here written in the land near La Crosse, Wisconsin, in the driftless area that escaped glaciation during the Ice Age. But during the Pluvial period runoff from the drainage had cut a channel down to the depth here shown. After that, runoff lessened and filled the valley with alluvium of increasingly fine texture. Time was allowed for a distinct soil-profile to be formed as marked by the dark bank. Such was the state of things when clearing and cultivation of slopes began in the past century. With clearing of slopes, storm runoff eroded and brought down coarser material that was spread over the original alluvial valley-floor. Some five feet of this material accumulated until still another stage of runoff regime was brought about. For runoff seemed to have increased, or erodible material had been removed, to give storm-flow greater cutting power. For runoff from cultivated and eroding slopes was sufficient to cut through recent and ancient deposits down to the channel bed of glacial times.

In the past, few reservoirs had been accurately surveyed. In our program of soil-conservation we needed to know how much storage-capacities had been depleted by silting. We had difficulty in getting suitable information. It would be much better to have accurate capacity-surveys made of reservoirs before they filled. The Boulder Dam was soon to be completed. It would take years and great expense to make an accurate contour-map in that wild and rough country. Drop of the great gates of the Dam in 1934 began the filling of Lake Mead and shocked us into action. Arrangements were made with the United States Coast and Geodetic Survey to use their precise surveys of the reservoir-site as base-controls. In eight days aerial photographers made the flights and began making a map with a scale of 100 feet to the inch and ten-foot contours. Repeated flights were made as the water rose, photographing the rising water line at 20-foot intervals as measured at Boulder Dam. This was done to give checks on contouring the flatter areas of valley-floors. This map of the reservoir now filled with waters of Lake Mead will serve for silt-surveys in the future and will increase in value and use a century, two centuries, yes, a thousand years hence.

Geodetic gravity-readings give us data of highest theoretical value, but also serve the geologist seeking out mineral deposits. Gravity-readings and sonic soundings serve for mapping the floor of the ocean. .

Planning for postwar work will call for a mapping program of unprecedented proportions to work out long-range uses of land, waters, and minerals of the Earth in the interests of human welfare. Especially is this true of China, whose people now are planning for a vast program of reconstruction. Geodesy will have an increasingly important place in earth-sciences.

Travel-lanes of the sea and highways of the sky have added to the needs of agriculture for greater knowledge of meteorology in forecasting of weather, storm, and flood. On my recent trip, our great hydroplane rose off the mysterious Nile at Cairo and wheeled over the sleeping city and took a northeasterly course over Sinai, Palestine, Lebanon, and the Syrian Steppe to Basra. Many students have ascribed the decline and decadence of this region to adverse change of climate. With the advantage of our bird's-eye view, we could make out ruins of former cities in a nearly empty land. Terraces of old had fallen down, soil-erosion had washed soils off the highlands to limestone bed-rock, leaving only dregs of the land in the narrow floors of valleys. These lands, bared of vegetation by ubiquitous goats, as I had studied them before, suggest lowered infiltration of rain, quick runoff, and reduced effectiveness of rainfall. Former ground-studies showed that reduction in effectiveness of rainfall was enough to account for decline of the country without adverse change of climate. For experiments reveal that misuse of land may reduce effectiveness of rainfall equivalent to an adverse change of climate.

My interest in this question goes back more than 20 years to North China. Decline of that vast land as seen in ruins of greater prosperity and larger populations of former times had been ascribed by RICHTHOFEN and HUNTINGTON and others to dessication as a result of adverse change in climate. But within the loessial regions in Shansi Province I found temple forests as green emeralds in a vast yellow gullied region. Within these temple forests vegetation was reproducing naturally without being planted or irrigated. Forest-litter covered soil-surfaces. Rains were being absorbed as they fell, for there was no evidence of runoff and no soil-erosion, whereas surrounding farm-lands were cut with great labyrinths of gullies. Soil-erosion from accelerated runoff on such a scale appeared to be enough to reduce productivity of the land without climatic change. Conditions within the temple forests indicated prevailing climate would support a complete cover of vegetation and control of soil-erosion. It was this finding that started me on a series of experiments to measure surficial runoff and erosion from land-surfaces under different uses. These experiments measured the effectiveness of rain. These and subsequent studies revealed that up to 50 per cent of heavy rain-storms may run off from bared sloping ground, whereas much less or no runoff comes from a similar slope covered with grass or forest and its litter.

Immediate runoff means loss of that much rain and gives the effect of dessication of a land. Before the theory of adverse change of climate is accepted it seemed well to discover in how far effectiveness of rainfall is changed by types of land-use--whether by unwise cultivation or by overgrazing.

At the ground-surface, meteorology and hydrology meet. The writer's studies on infiltration of rain and later studies by MUSGRAVE and others lead to the important conclusion that methods of land use influence the intake of rain by soils to decisive and critical amounts. Rates of infiltration are critical in land-use, in erosion-control, soil- and water-conservation, and in flood- and silt-control.

Success or failure of sustained uses of land and of man's adjustment to it--in fact, the destiny

Fig. 11--From the air is here seen the early stages of a man-made desert in the "Dust Bowl" of the Great Plains. These sand-dunes were created in ten years of misuse of the good and fertile earth of the Southern Great Plains. The process of destruction has been reversed and the dunes controlled and revegetated, a task much simpler than the control of less spectacular but more destructive water-erosion. An understanding of the characteristics of land and geophysical processes is required, wisely and safely to use the good earth.

Fig. 12--The direct relation between misuse of land and welfare of farmer and eventually of civilization is apparent in this aerial view of a Georgia farm. Sustained and improved use of the good earth calls for the coordination of a number of technologies within the field of earth-sciences and geophysics.

of civilization--is determined far more than now realized by what happens to the rain-drop as it strikes soil-surfaces.

Moreover, a more complete understanding of climate and its variations, whether periodic or cyclic, will aid in adjusting agriculture and other uses of land to given regions. Especially is the study of microclimate coming into the forefront in agriculture and in making long-time use of forests and in reclamation of damaged lands.

Dynamic action of wind as it erodes rock and soil and carries sands and dust is a factor of high importance the world around. Wind-tunnels were first used for design of airplanes. Now portable wind-tunnels are used to measure wind-erosion of soils under different wind-velocities and under various measures for control of wind-erosion.

Sorting of soil in wind-erosion takes place, whereby particles of silt and clay are swept aloft to be blown to destinations unknown, and the coarser, sandy particles are left behind to form hummocks and sand-dunes. These "black blizzards", as we experienced them in the "Dust Bowl" of the Great Plains, have been known in lands long occupied in the Near East and in northwest China. A study of sand-dunes should give us a clearer understanding of past climates, possible climatic changes, as well as of formation of man-made deserts in marginal regions.

Factors of meteorology, including weather-forecasting and climatology, affect the destiny of human occupation of the Earth in many ways and decisively. In marginal zones, the effects of drier climates may be brought about by misuse of land- and water-resources. Full use of the land and waters calls for deeper understanding of all phases of this complicated science.

Hydrology is a synthesis of those subjects that have to do with the source, distribution, disposal, and work of waters on land. The ocean, as the mother of waters, is the source of rain. Its volume is almost 335 million cubic miles. Rivers run into the sea, yet the sea is not full. Waters of the ocean evaporate, are blown inland and rain down on the land, and their return in rivers to the sea makes up the hydrologic cycle. Rainfall on the land is computed at about 29,347 cubic miles, and runoff of rivers is about 6,524 cubic miles, or about 22.2 per cent of rainfall. Cold, dry air-masses take up moisture from land and carry it back over the sea to balance the equation of evaporation and precipitation. It would take 11,400 years for the volume of the ocean to be rained down on the land, and 51,280 years for the ocean to be filled by rivers running into the sea. Accumulation of ice-sheets might thus lower the level of the ocean quite rapidly in geologic time.

Properties and dynamics of rain-waters on the land are of fundamental interest in the economy of the Earth. Annual rainfall on the land (for rain at sea is not recorded) weighs about 123,259 billion tons, equivalent to the fabulous energy of 7,470,000 million horse-power. The compacting force of rain on bare soil is no small matter. Recent studies disclose remarkable effects of rain-drops as they strike bare soil on slopes.

Moreover, it is the circulation of this small part of the Earth's waters that has been the chief dynamic agency in moulding the face of the Earth and in setting up great stresses in its crust.

Running waters through the ages have excavated valleys, planed off the land to near level, transported erosional debris and spread it out in great sedimentary deposits, doing a prodigious amount of work. Cumulations of these deposits in time build up great overburdens, such as I saw from our hydroplane in the delta of the Zambezi River in East Africa, that disturb equilibria of the delicately balanced Earth's crust. These overburdens weigh down and slowly sink the crust into the underlying plastic magma to cause land-uplift elsewhere. These uplifts in turn set the stage for other cycles of erosion, sedimentation, and crustal movements. With these are associated faulting and possibly some volcanic activity. The dynamic action of rivers is far-reaching and decisive in the history of the Earth. Such is the mechanism whereby silent energy of rays of the Sun moulds the surface of the Earth.

It is this geologic erosion which has sculptured the land into forms of majestic beauty such as the Grand Canyon of the Colorado, fantastic Bryce Canyon, the little-known gorge of the Bramaputra, and thousands of lesser ones. Rivers and glaciers have wrought wonders. We have in these gigantic phenomena much more to call forth the exclamation that was sent as the first telegraphic message, "What hath God wrought."

Erosion of the land is such an universal phenomenon of running water that confusion sometimes arises as to the difference between this geologic erosion and the accelerated or man-induced erosion of cultivated fields or of hills from overgrazing or of bared land. The dynamics are the

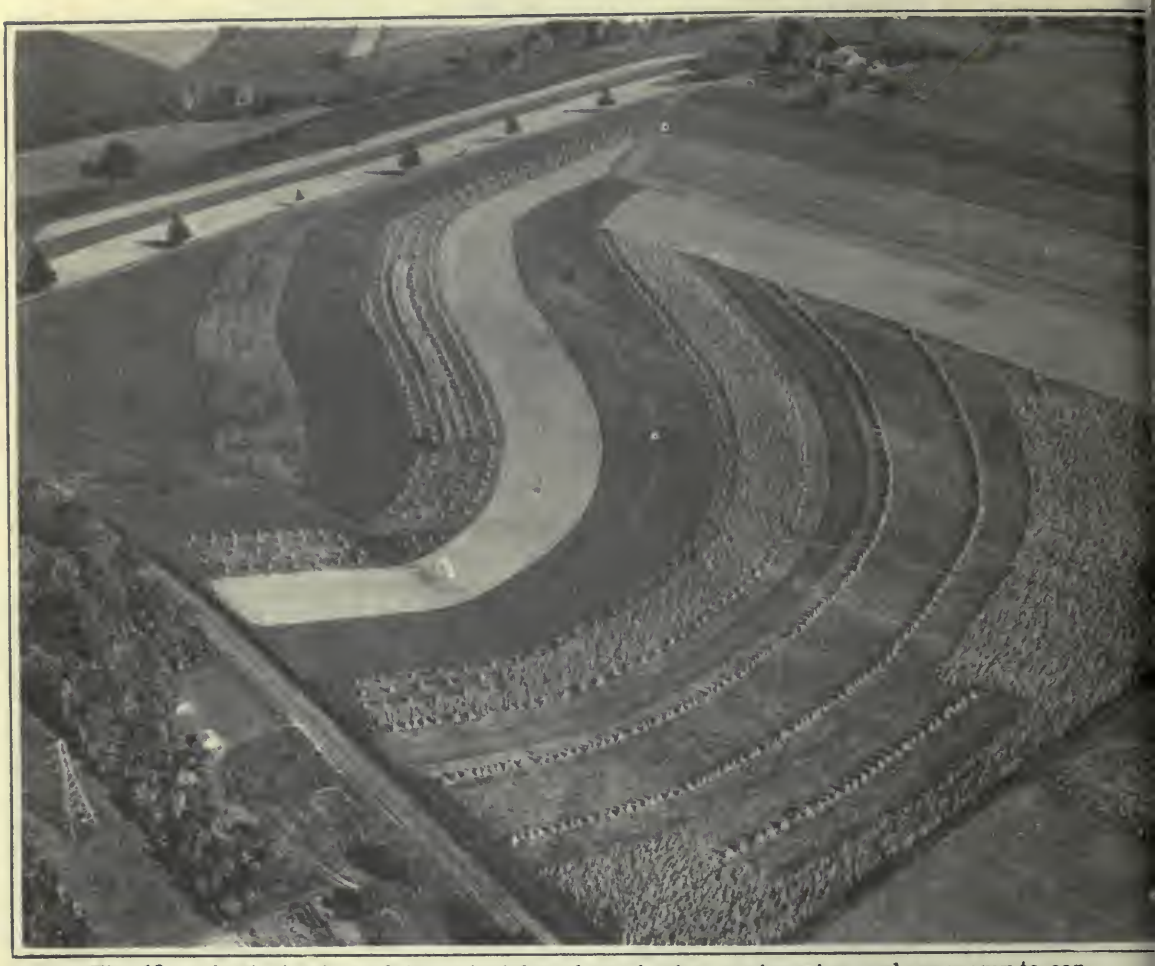

Fig. 13--A beginning in applying principles of geophysics, engineering, and agronomy to conservation of land is shown in contour-farming and alternation of strip-crops, to increase intake of rain by cultivated soils and to reduce erosive action of unabsorbed rain-waters--Lancaster County, Pennsylvania.

same. But geologic erosion is as old as the first rain-storm; wind-erosion may be older. In those areas where favorable climate supports a complete cover of vegetation, a complex body of soil is formed under this protection. But geologic erosion goes on no faster than soil is formed. Soils form and differentiate into topsoil and subsoil on slopes, as valleys are excavated. Geologic erosion under such undisturbed conditions is a slow process in terms of a civilization.

But when this mantle of vegetation is cleared for cultivation, or for any other purpose and especially when the land lies on a slope, erosion of a new order comes in. Erosion is accelerated far beyond its normal geologic rates and much faster than soil is being formed and means destruction for human use unless controlled. This is the soil-erosion which must be adequately controlled if sustained production of land is to be maintained as an enduring basis for progress of civilization.

Dynamics of running water, when acting upon soils formerly protected by vegetation and especially on slopes, is a phase of hydrology of highest importance in working out a permanent agriculture to make sure a food-supply for peoples of the Earth. Lands must be so treated as to take in rain that falls on the land. In drier regions, loss of effective rainfall may be critical. Increased storm-runoff cuts and carries away the soil and means more silt in streams to add to problems of use of waters for power and irrigation and flood-control.

On my first trip to China more than 20 years ago, when still a day's journey from Shanghai

Fig. 14--A bit of the Earth's surface in Lancaster County, Pennsylvania, two miles northeast of Tayloria, as seen from the air, showing on the left how land is being depleted by unwise use and on the right how land is treated to conserve the fertile layer to maintain and to increase production of needful food-crops.

we entered a great broad band of brownish-yellow water, sharply contrasted against the blue-green waters of the ocean. Next morning my bath-tub water was heavy with silt. We were plowing through soils of China washed out into the sea by the Yangtse River.

Later, on an expedition into North China, I visited the site of the break in 1852 in the dykes of the Yellow River, when the great muddy stream changed its outlet from the Yellow Sea to the Gulf of Chihli 250 miles to the north. I climbed first the outer dyke and seven miles farther on the great inner dyke and looked upon a great brownish river full of shoals--the siltiest river on the Earth. This was "China's Sorrow" that was flowing some 30 feet above its delta-plain. For 600 years, millions of Chinese farmers had with bare hands raised the dykes year by year, over a distance of 400 miles to hold this giant river in its course, until it finally broke away.

Why should the Chinese farmers have to work so hard? It was because of silt, that each year partly filled the channel, making it necessary to raise the inner and outer dykes year after year, until finally the bottom of the channel had been lifted well above its plain.

I resolved to see the origin of this silt and went on another expedition into the loessial highlands. There we found the King River Irrigation-Project begun in 246 B.C., which had been put out of use time and time again because of silt. In the river-drainage I found a vast region cut up by enormous active gullies, despite the valiant defense of unaided Chinese farmers through the

Fig. 15--Possibilities of making use of water-resources are shown in this aerial view of Bonneville Dam on the Columbia River. Cheap power from streams, from year to year, generation to generation, offers one of the most important means of making full use of Nature's resources in the interests of human welfare. (Washington National Guard)

centuries. But occasionally, in the midst of gullies, I found temple forests and grazing enclosures, to which I have already referred, where there was no erosion.

We began a series of experiments in the forested areas and on the adjoining farmed and denuded areas to run down the basic cause of reduced infiltration from bare soils and the resulting increased runoff and erosion. The decisive fact is very simple. Bared soil-surfaces tend to be sealed by muddy suspensions under the impact of rain, whereas soils protected by a layer of forest or crop-litter or grass-cover prevent the formation of muddy sealing suspensions, so that pores and interstices into the soil remain open for absorption of rain-waters to full capacity of the soil-profile. These studies answered some long-standing questions and furnished the basis for a more thorough attack upon erosion. These studies have since been expanded by many investigators to include a wide range of conditions to answer questions for different physiographic regions. Hydrological experimental areas have been patterned on the San Dimas Study, founded in 1930, to find the facts needed for conservation and control of rain-waters. A network of such comprehensive hydrological stations is urgently needed for the entire United States.

For five field-seasons (1922-1927) I made studies in the loessial highlands of North China and have recently returned from a survey of northwest China. Here soil-erosion is active on a tremendous scale that has been going on for a long time. Great labyrinthian gullies cut up the landscape into fantastic panoramas. Nowhere else on Earth have I seen soil-erosion on such a scale.

Excessive rates of erosion are shown in silt loads of streams measured recently by the

Yellow River Commission as percentage of water by weight: Yellow River at Lanchow 1942, mxm 18.75; Yellow River at Chenchow 1942, 46.14; Wei River at Sienyang 1941, 35.55; King River at Chang Chia Shan 1937, 54.70; Loh River at Chongto 1934, 63.00.

The Yellow River Commission has come to the decision that control of soil-erosion in the drainage of the Yellow River is necessary to flood-control on the delta-plain and to effectiveness of irrigation-projects. Now the Government of Free China has begun a program for the control of erosion and the conservation of soil and waters.

All of China is not equally subject to such heavy rates of erosion. More than 22 centuries ago a Chinese engineer by the name of LI BING set up one of the most successful irrigation-projects of history on the Min River, which flows clear out of the border mountains of Tibet. This project is still in excellent working condition and serves to irrigate the Chengtu Plain of 500,000 acres that supports 2,000 persons per square mile.

LI BING did not have a silt-problem to deal with but he did have bedload of boulders and gravel and annual high-waters. He correctly diagnosed this problem and prescribed simple measures and made their yearly observance a religious festival, one of which I attended on April 1-5, 1943. LI BING provided for inner and outer canals. At the time of low waters in winter the river-flow is diverted by a coffer-dam into the inner canal, while debris is dug from the outer canal; then the coffer-dam is opened and the inner canal is shut off with a second coffer-dam and is emptied and dug out to "iron dragons," set at a depth to which the channel must be excavated each year. When the work is complete, a great annual ceremony takes place at the breaking of the coffer-dam of the inner canal. Then waters are divided into the two canals to begin another irrigation-season. By dividing the two big canals into some twenty-odd lesser canals, flood-damage is avoided. So successful was LI BING in his original plan that the Chengtu Plain has not suffered from flood or famine for 2,000 years. We must honor such an engineer who was successful in controlling wild waters for the benefit of mankind and for so long a time.

It is scarcely necessary for me to cite what has been done in the United States to put the knowledge of the Earth's resources and natural forces to work here. These matters have been set forth in a galaxy of papers in this and former annual sessions of the American Geophysical Union. In the field of hydrology, information vital to establishing the sustained utility and productiveness of waters and land is being amassed in experimental installations and in practical application of such information over millions of acres of land. In the United States a beginning has been made to work out the basis for sustained and improved production of land- and water-resources in accord with principles established in the science of geophysics. While excellent progress has been made in recent years, far more needs to be done if wastage of land and water by erosion and its damaging effects are to be put under control in time to save vast areas of the best land of America.

The hazards of war, as well as those of peace, call for progressive synthesis of the several branches of geophysics.

Dynamics of flowing water present the chief hazard to a lasting adjustment of mankind to the Earth, and at the same time the greatest hope when controlled and put to highest possible uses. It is in the control and conservation of rain-waters as they fall on land and flow in streams that mankind may keep up his food-supply in abundance. Little will avail in other phases of civilization if the production of food is undermined and lessened in the face of increasing demands. When food fails, all else fails. There is no safety in a famine except in death.

As I flew over Mesopotamia with its hundreds of dry canals and ruins of former magnificence and power in the midst of present-day underpopulation and waste, I pondered the fate of mankind on this Earth. With all his boasting and pomp, man is a child of the Earth, dependent on favorable combination of natural forces and materials and their wise stewardship in the interest of survival of our civilization. The children of men may work out a lasting adjustment to the Earth only by seeking knowledge and understanding of the marvelous forces and their interrelations and by working <u>with</u> rather than <u>against</u> them in this world of wonders and the scene of the great adventure of mankind.

Soil Conservation Service,
Washington, D. C.

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Five Years of Planning in the Pacific Northwest

By CHARLES McKINLEY

Published by
Northwest Regional Council
Portland, Oregon
May, 1939

FOREWORD

The Fifth Regional Planning Conference recently held in Seattle opened its session with a searching inquiry by Professor Charles McKinley into the activities of our state and regional planning commissions since their establishment five years ago. What most pleased the students of planning, I believe, was the emphasis placed by Professor McKinley on the diversity and importance of the tasks that remain to be undertaken, rather than what has been accomplished.

There is in this thoughtful address a message of significant value, not merely for planning officials, but for all the people of this region. There can be no doubt that in recent years our civilization has expanded far faster than our knowledge of it. On every hand we are faced by problems to which we do not know the answer. It is this pressing need for knowledge of the facts that control our destinies without our being aware of them, that has created the planning agencies, not only of this Pacific Northwest, but of the nation. It should be more widely understood that these bodies neither have nor desire any executive or legislative powers; that they are, on the contrary, simply agencies of inquiry and research, whose activities are determined by request of administrative officers or the elected representatives of the people. Findings of planning agencies are available for the use of private as well as public organizations.

Secretary of Agriculture, Henry A. Wallace, has pointed out that no government can be wiser than its information. It is the first task of planning bodies to locate this information wherever an agency of research has impartially collected it, or, wanting such an agency, to make the necessary research itself. Since the capacity of our planning agencies is far outrun by the need for information sufficient to lift the political, economic and social life of our people to new heights of efficiency, Professor McKinley has given welcome and timely amphasis to the desirability of encouraging and coordinating the efforts of ALL agencies engaged in research.

Because Professor McKinley has presented an able review of the past and potential role of planning in the Pacific Northwest—with broad national implications—the NORTHWEST REGIONAL COUNCIL *considers it a privilege to publish and give wide currency to his address. We believe that all who find opportunity to read it will have a greatly clarified concept of the prime needs of this region and of the way in which they can be met.*

B. H. KIZER, VICE-PRESIDENT
Northwest Regional Council

May 15, 1939
Spokane, Washington

FIVE YEARS OF PLANNING IN THE PACIFIC NORTHWEST

*By Charles McKinley**

A REVIEW

It is nearly five years since the four states of the Pacific Northwest established planning boards and united with representatives of the national government in regional planning. Before that time such federal bureaus as the Corps of Engineers, the Forest Service and the scientific bureaus, the State Colleges, the Experiment Stations, the Universities and some of the state departments had gathered and analyzed much basic data concerning the physical resources and economic problems of the region. But the creation of the official planning boards introduced a new and greatly needed factor of coordination; it helped to knit together federal, state and local planning policies; it enlarged the view of planning objectives.

Let me hasten to note that a galaxy of new agencies, federal and state, gave additional impetus to the planning process in the region. These include the Soil Conservation Service, the Farm Security Administration, the AAA, the Bonneville Project, WPA and PWA, the Grazing Division, the Water Conservation Boards of Montana and Idaho, the Conservation Department at Olympia, the Unemployment Compensation Commissions and other social security agencies.

I cannot pretend adequately to appraise what has happened since the regional and state planning agencies were started. They have been so busy, have covered so much territory, that only a participant more intimately familiar with their manifold activities could undertake that task.

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* This paper was presented as the keynote address of the Fifth Pacific Northwest Regional Planning Conference, Seattle, April, 1939. Charles McKinley is Professor of Political Science at Reed College, Portland, Oregon, and Chairman of the Portland City Planning Commission. He served as a Consultant on the Staff of the Columbia Basin Study made by the Pacific Northwest Regional Planning Commission (*Regional Planning: Part I—Pacific Northwest,* National Resources Committee, May 1936).

But as a sympathetic observer I have tried to sense the general directions of planning activity, to watch the methods developed and to understand the more significant problems of the region as they are emerging from facts and conclusions that have been developed.

Let me say a few words about the methods pursued. The achievements of the planning boards in these five years have been attained largely by stimulating, aiding and coordinating the activities of many other agencies. While each of the planning boards has done much significant work through its own special facilities, most of its tasks have called for the active cooperation of many public and private groups. There can be little doubt that the lasting success of planning boards will depend upon the degree to which they secure this coordinated interagency activity of all groups whose work touches upon the problem in hand. They cannot become substitutes for such agencies. If they do their job they will try to re-enforce the work of every state and federal agency which is performing a socially useful activity. This is what the planning boards have repeatedly declared, and on the whole their acts show that they mean it.

It is true, that the state planning boards have undertaken some studies in fields of interest lying within the domain of state administrative agencies. For example, tax studies in Idaho, Oregon and Washington; educational studies in Washington; public health and welfare in Washington; and dependency and delinquency problems in Oregon. But in these cases there appeared to be no other agency equipped with staff or funds to undertake the research required. The state departments should take over these tasks as rapidly as they are prepared to do so, leaving the planning boards to synthesize, to coordinate, and direct joint inquiries and to carry on limited special studies that no other agency is equipped to do. One measure of success of state planning will be the extent to which the adoption of planning techniques and attitudes by the regular state departments relieves the boards of such special tasks.

Sir Henry Bunbury has spoken of planning as the process of taking all factors into account in the making of public policy. Accepting this as a reasonably satisfactory conception of the planning function, we may use it as a guide in glancing at our recent experience in this region. It follows from this definition that planning must rest not only upon common sense experience but upon the recognition of relevant facts that escape superficial observation. Common sense is not enough in an age of science. This is the case for research as a basic ingredient of planning, a case brought home to a constantly growing number of citizens in the Pacific Northwest. The studies made under the auspices of the planning agencies touching the whole range of physical resources, and many problems of social life, have immensely enriched our knowledge of significant basic facts. If we have the will to deal with the problems which they illuminate we are in a far more advantageous position to do so than we were five years ago.

Despite this progress, however, it is still true that on many, perhaps most, problems a great deal of research remains to be done before detailed policies can be worked out. The problem of land use is an illustration. Despite the years of quiet work done by the Bureau of Soils, the State Experiment stations, and the State Colleges, despite the great acceleration of studies in land use and classification during the period since 1934, precise information concerning the quality of soil, topography, moisture, frost data, etc., of a particular land unit (which some prospective farm purchaser needs to know) still can not be furnished except in a minority of counties. In Washington, where this work is most advanced, eleven counties have received detailed soil surveys, and four more will be completed in about two years. I shall point out a little later some of the useful planning that is going forward despite incomplete information, but it is necessary to recognize clearly that many phases of public policy for conserving and developing our physical resources cannot be accurately and fully developed or applied until a vast amount of obscure but systematic data collection has taken place.

What is true with regard to the gaps in our information about land is equally true with respect to water. About mineral resources there is even greater ignorance.

So long as public policy was based upon the objective of exploitation, these inadequacies could be viewed calmly because after all it was the function of the entrepreneur, be he farmer, mine owner or business man, to dig out the information he needed for making a profitable enterprise. He was not concerned with the *social* cost accounting. In an era of expanding population and world commerce he had an assured market and he could take long chances to get his share. But when we turned to a public policy of sustained yield, or of use with a minimum of waste (which is the gist of "conservation") public research assumed a place of greatly increased importance. If the individual farmer is to be asked to protect the soil for future generations, he must be shown how to do it, by physical structures and crop practices. If the timber operator is to be induced to adopt sustained yield management, he must learn the best methods of logging to avoid the destruction of young timber, to reduce fire hazard, to reseed the land. If a community containing marginal land (and what western community does not?) is to escape useless public expenditures, and human misery, it must know what lands are unfit for farming. All these goals call for knowledge which publicly sponsored research must make available. The planning movement has made real headway in amplifying this kind of information, and showing its importance.

But planning research must also enter the area of social analysis. And here also a real beginning has been made. With the launching of the social security program, particuarly unemployment compensation, data have been rapidly accumulating which will soon yield facts of major importance about the patterns of employment of the people of the region, about cycles of industrial activity, about wage payments, about training required for job success, about technological changes, and many other significant phases of industrial life in the region. Studies of popu-

lation trends by the Regional Planning Commission and the state planning boards have begun to open our eyes to changes that will vitally affect the lives of every one of us, changes of which we were nearly all ignorant a few years ago. Only a decade ago Portland embarked upon a school building program which has had to be drastically modified, after considerable misplaced expenditure, because the plans on which it rested did not sense the radical changes in birth rate, in longevity, and in immigration policy that have in this short time greatly affected the number and proportion of school children of different age levels. I shall comment more fully upon the facts shown from the most complete study yet made of the migrations into this region since 1930 by the Oregon State Planning Board, but let me say here, that this kind of analysis would not have been possible before 1934 because certain of the sources of information essential to it did not then exist.

It is possible, however, that research has proceeded faster than coordination, and coordination more rapidly than the process of public understanding. Without permitting either of the former to flag, it is certainly essential to widen and intensify public discussion of the facts and conclusions emerging from this planning activity. The recent repeal of the Oregon Planning Board act is proof of that. It is a bit ironic that this repeal was made effective by a Governor whose legislative program drew heavily upon the information and proposals developed by the planning agencies. Because these Conferences are held to further public discussion, it may be most useful if I direct our thinking toward the major regional problems which I believe the developments of the past five years have revealed.

MAJOR PROBLEMS OF THE PACIFIC NORTHWEST

1. Forest Depletion

The Forest Industries seem to me to top the list in the "problem child" category. Building upon the careful work long under way in the Forest Service, the state and regional planning boards have brought the main difficulties out into the arena of general public discussion, and have focussed upon them a series of proposed policies. While the acuteness of the problem varies among the four states, with Washington heading the list, the issue is of major importance in all except Montana.

The last general study prepared under the auspices of the Regional Planning Commission and printed in March 1938 shows that for the four states forest products furnish more than 40% of the value of commodities shipped from the region; that 63% of the railroad freight tonnage originating in the region consists of forest products; that in rated capacity of prime movers in 1929 the forest products manufacturing plants had almost ten times the horsepower installed in all other manufacturing plants, 643,000 against 69,000; and that in addition, the forest products had 40% of all electric motors using purchased power. Population density tends to coincide with lumbering except in southern Idaho, Montana and eastern Washington. All cities of above 20,000 population except four are located in areas where lumbering is the chief economic activity. In 1930 one out of every eight persons gainfully employed in Oregon and Washington was working in a forest industry. The number of employes of service industries dependent upon this industry cannot be precisely calculated but must be somewhere near equal to those directly employed in the industry. So far as employment in manufacturing is concerned the fabrication of forest products required more than half the factory employes and paid more than half the salaries and wages. These are but a few of the facts that demonstrate the crucial importance of timber industries to the region as a whole.

I shall not discuss here the importance of the forests for water flow, for preventing erosion, for wild life, livestock or recreation.

Despite the declining use of timber for building purposes caused by the adoption of substitute materials the forests are being rapidly depleted, with the rate varying greatly within subdivisions of the region. For the region as a whole, the average annual cut from 1925 to 1933 was over ten billion feet while the annual net current growth after deduction for all losses was estimated at four billions. At best it will be many years until growth can overtake depletion but that is no argument for not making strenuous efforts now to achieve as rapid a growth as advanced silviculture can make possible. I must take for granted here that the case is fully made that the commercially accessible fir timber (for saw purposes) in western Washington, and in northwestern Oregon, the white pine of northern Idaho, and Ponderosa pine of eastern Washington and Oregon, are threatened with early depletion unless a program of sustained yield management is speedily adopted. The heavy stands in western Oregon south and west of Salem still offer time for a more leisurely pace in the rectification of timber management policy.

The social consequences of the failure to place this industry under sustained yield management can be fully seen in the cut-over regions of the Great Lake states, or more readily in the sub-regional districts of the Northwest where the timber is gone. No complete census of communities ruined by forest depletion has been compiled. Yet the staff of the Regional Planning Commission was able to compile a list of 76 towns devoted to wood products that had completely disappeared, and a second list of 77 towns whose population had heavily declined because of the abandonment of lumber mills. A drive through the Willapa Bay-Grays Harbor country in western Washington will show pretty clearly the economic decay and community dissolution that await the people of that cut-over forest area within the coming decade unless some miraculous substitute employment is discovered. This economic blight creeps

apace even into the larger towns of Raymond, Aberdeen, South Bend, and their sister cities where mills are still cutting. Though there is some prospect of increased use of pulp species, the saw timber is nearly gone. It is now too late to avoid by sustained yield the damage done or in prospect for this group of important communities. Despite the relatively rapid growth of trees in this moist district, its present population cannot wait two generations for a new forest to reach commercial size.

A situation similar to that in Grays Harbor threatens many of the other timber-dependent communities of western Washington. There is still time to maintain the towns of the Cowlitz River-Longview area, provided the forests north and northwest of Longview can be placed upon a sustained yield basis within a few years. A plan for a reduced but sustained operation in the Shelton area of the Olympic Peninsula has been worked out and this will probably be adopted. No accurate study has been published showing the precise situation in each subsection of the Northwest. But it is pretty well known that a short time will finish the commercial Ponderosa pine operation in eastern Washington. The big mills at Bend in central Oregon have only a decade or so left unless a sustained yield program, with a considerably reduced cut, is rather quickly adopted. In the Klamath Falls area the present sawmill capacity and annual cut are greatly in excess of the timber producing capacity of the region. The Burns operation supplied from the Malheur Forest is on a stable basis, and so is the new mill at Prineville which cut its first "sustained yield" log last summer.

I recite these forest industry problems not with any intention of blaming lumber operators, either en masse or in particular. Caught within the net of a highly competitive situation, with declining timber use for building, with high timber taxation, with increasing fire hazard as the public invades the timber area for recreation, with heavy fixed capital charges, with too small assured timber supply within his own control, it is perfectly natural for the timber operator to pursue a policy

of liquidation. There are few of us who would pursue a more philanthropic course were we faced by the same difficulties, unless the northwest community could help us find a way which would relieve these financial pressures that drive us toward liquidation.

What must be done to place the forest industries upon a permanent cropping basis is pretty thoroughly known. The problems and remedies have been set forth with particularity in the reports of the state boards and in the regional report to which I have referred. Sufficient public interest has been aroused to secure the adoption of a number of important legislative changes, although in no state has the full recommended program for state action been accepted nor has the Congress accepted all of the responsibilities required of the national government. Helpful legislation by state and federal government to facilitate fire protection on state and private timber has been adopted; tax laws to encourage reforestation and the holding of land growing new crops have been adopted in some of the states; laws to encourage the state acquisition and management of cut-over tax-delinquent land have been passed (the most recent case is the Oregon law of the last session); the Forest Practice Rules developed under the Lumber Code are recommended by private associations to their members and to some extent are being observed; federal aid to prevent the destruction of lumber by parasitic pests has been given. But still the fact remains that only two companies in the pine region are today being managed upon a sustained yield basis, and not a single firm in the fir-pulp region of the west Cascades is now operating upon a fully sustained yield management basis.

Moreover, while the practice of selective logging in the pine regions, pioneered by the Forest Service, has made marked advance, this method of logging within the fir region has made very little headway as yet. In the case of many of the big operations, logging methods which use machinery designed to satisfy the gargantuan appetite of the huge mass production mills make it very difficult to log on a tree selection basis. The large capital overhead seems to demand that everything be

eaten or destroyed, leaving behind wastage offering special invitation to the demon fire to ravage the land so that a new seedling forest will find its life perpetually menaced.

This economy of capital liquidation doubtless accounts for the pessimism of some of the best informed business men in the region. It explains the remarks, reported in the press a few weeks ago, of a leading Portland business man to one of the service clubs. He is alleged to have said in essence that we might as well kiss the forest industries goodbye and try to find substitutes through increasing the intensification of agriculture and the processing of berries, fruits and other crops. Laudable as is his substitute suggestion, it is not adequate.

We have still the chance to save many of the menaced communities from wreckage if we act in time. But time is of the essence. Nor will half-way measures, half-way financed, avail us. If we must cross a raging torrent a plank half long enough to reach the opposite bank is as useless as no plank at all. It seems to me that if the plank in this case is to be made adequate for the purpose, the way must soon be found for consolidating many small diverse timber ownerships into units large enough for continuous and permanent timber harvesting. There are about 40,000 different timber ownerships in Oregon and Washington. Likewise of key importance, the reports indicate, are changes in tax policy on mature timber stands, and provision for financial credits to encourage the transition to a sustained yield policy. Lastly, good forest practices must be observed by all operators so as to remove the unfair advantage of the operator who will not heed the need for future forests.

Here is one of the greatest challenges to the people of our region, a challenge which the planning agencies have done much to make clear, a challenge which must be met soon. The last five years of work have brought the problem out into the open as never before. Signs multiply that the people generally are awakening to the issue. When county officials invade the office of the Regional Forester, demanding to know

what can be done to stabilize their communities by obtaining sustained yield management, it is most heartening. When private citizens inquire of lumbermen whether or not they are practicing sustained yield management, whether one would be warranted in building a good home in a lumber community, it is a hopeful sign. When the citizens of one of the remoter Oregon counties where lumbering has not yet begun insist that lumbering start upon a scale modest enough to permit a permanent sustained forest industry, it is most encouraging. It is heartening to find the Pack Foundation financing the systematic exploration of the possibility of sustained yield management on the properties of certain private companies in the State of Washington. It is a favorable sign when a Saturday Evening Post full page picture advertisement for diesel caterpillar logging equipment stresses selective logging with the banner: "Lumber for today; timber for tomorrow." Leaders in the industry will do well to note this heightened public interest and turn it to constructive account by supporting wholeheartedly the program of action which has been developed by the planning agencies.

This rapidly growing public opinion must be married to political and community leadership, and implemented by legislative and administrative action at all levels. Signs of this are present also. Governor Sprague of Oregon clearly recognized this problem in his inaugural address last January.

Planning agencies have in this situation the responsibility of continually charting changes in the basic facts, refining the problem as it is found in different communities in the timbered areas, working out the necessary legislative action even into the form of detailed bills, selecting the most important and strategic steps from the merely useful and helpful and keeping them before the eyes of the political leaders. This is about as far as *they* can go. Whether their work brings fruit or futility depends upon the ability of democracy working through its political leaders to develop the will to solve community problems.

2. Use of Limited Farm Land

There are still too many publicity agents in the Pacific Northwest who write as if every acre of our land was "born free and equal." The fact that the region contains about thirteen per cent of the land area of the nation is used to justify the conclusion that it ought to support a corresponding density of farming population. The data developed by the land planning agencies make it perfectly clear that most of the land area is unfit for farming. While completely accurate information is not yet available, the best estimates tell us that only about twelve per cent of the area of the region is potentially arable.

This land is nearly all in private ownership now, save for a few pockets here and there among the remnants of the public domain in federal and state ownership. Most of it is already under cultivation. The number of new people who can therefore find opportunity in agriculture is distinctly limited. The principal opportunity to care for new farmers will come from the addition of irrigated valleys, and from the more intensive use of the Willamette Valley through supplemental irrigation. In the irrigated area in Idaho, western Montana and eastern Oregon and Washington some increases may come from the more adequate supply of water in areas already irrigated. It is estimated that about ten million acres more farming land, constituting not more than 150,000 farming units, might ultimately be made available through irrigation, clearing, drainage and dyking. All of these sources of opportunity will be urgently needed for the farmers already here or likely to come within the next few years. To accurately appraise these opportunities for added farmers, to find ways of accelerating and cheapening the process of making these new acres ready for the plow, is one of the major tasks now being undertaken by the Regional Planning Commission and its affiliated state and federal agencies in their current study of the Land Settlement-Migration-Public Works problem.

But the discovery of these modest increments of farming land is not the only obligation of the Northwest to its potential farming population.

We must also strive to prevent the recurrence of the tragic experience of other regions and of certain sections in the Northwest where past booms have brought under cultivation districts that were unsuited to farming and produced bankruptcy rather than crops. Thus in the upper Rogue Valley in the boom of nearly thirty years ago, orchards were planted on bench land entirely unsuited for this purpose. Some of the old tree stumps stand there yet as mute monuments to ignorance or cupidity. Yet all over the region tragic errors were made when lands unsuited either because of soil qualities or unfavorable temperature and moisture, made successful farming impossible. Through much bitter experience these submarginal farms have been discovered in every section of our region.

I have already alluded to the research work on land classification which has gone forward since 1934. Even if the present expenditures for the detailed studies ultimately required are continued, it will be at least a decade before information is available for all the states. In the meantime settlers need guidance. Ultimately we must adopt zoning control which will mark off the broad divisions of suitable from submarginal farm land, even though there will be some difficulties of application because of the fluctuations of moisture and markets which increase or contract the marginal areas.

A most promising short cut to this urgently needed land information may be found in the work now going forward under the county land planning committees of farmers and agricultural officials sponsored by the Department of Agriculture. In every state these groups are meeting and working out a rough determination of areas suitable and not suitable for permanent agriculture. When this information has been compiled it will furnish a useful guide for county officials, county agents, community leaders and others concerned in stabilizing land settlement. That there will be resistance to the use of this information from owners or brokers of real estate wishing to sell submarginal land for farming purposes must be expected. Such resistance has already shown itself in

certain counties where studies have been completed and published. Whether agricultural advisory agencies and local public officials will buckle under the weight of this vested interest opposition (as has so often happened in urban zoning control) will be a crucial test of the value of planning. If this information is to be effective, new methods must be devised to advertise it and make it readily available to every newcomer seeking farming opportunities.

While the destruction of top soils in this region has not been dramatized as has soil erosion in the western Great Plains or in the Mississippi Valley, we too have our problems of wind and water erosion and soil depletion. For years we have had our spring and summer dust storms in the Walla Walla country and on the high plateaus of the mid-Columbia wheat lands. Yet we were blind to their meaning. We have seen the heavy winter rains west of the Cascades swell the Willamette with swirling silt washed from the orchards and plough lands of the valley. In the Ponderosa pine forests and on the open range we saw the lush bunch grass and the browse give way to weeds, sage brush and grease wood as overgrazing killed off the rich original vegetation and exposed the top soil to wind and water. We saw all these things and yet we did not truly see what was happening. Something like a revelation has come during these five years in the public awakening to the threats of soil exhaustion. The Soil Conservation Service, the AAA, the state and local planning boards, the Extension Service, the Forest Service and the Grazing Administration have all played an important part in creating this change, and in starting the Northwest back on the road toward soil conservation.

But Northwest agriculture suffers from many other ills created by disturbances to international trade, by the depressed buying power of urban dwellers in other parts of the country, and by the high freight costs borne by products from a region so far away from consuming centers. It was not the attempt to use submarginal land that led to the critical situation of most of our wheat growers or of the apple growers

of Hood River, Wenatchee and other mountain valleys. The tragic experiences through which these farming folk have gone could not have been prevented by the most careful program of land utilization or regional planning. That our wheat growing economy has come to depend upon government subsidy and export dumping is a fact which lies quite outside any regional control. Here state and regional planning can do little save call the attention of national leaders to the farmers' plight and urge the formulation of a long-time national policy to promote a sound and stable farming economy.

3. Water Utilization

A revolution in the point of view toward water resource planning has occurred in America during the past five years. This is the conception of multiple use planning which harmonizes the needs of navigation, power, drainage, irrigation, domestic supply and wild life. Leonardo de Vinci, early in the 16th century, used this approach in his elaborate sketch for Francis I of France when he proposed to develop the Loire system for navigation, irrigation, water power and domestic water supply. But this comprehensive approach to the utilization of American water resources has been neglected until recently. Acting under the guidance of the Water Resources Committee, the Pacific Northwest Regional Planning Commission and the Pacific Northwest Drainage Basin Committee (with its subcommittees) have been diligently working out a development program based upon the objective of maximum multiple use. The principal state and federal agencies concerned with collection of water data, and the utilization of water, are represented on these drainage basin committees. Their joint endeavors to perfect and amplify the essential basic data and to work out an orderly and balanced plan of development projects are not spectacular but they are fundamental to the sound utilization of this exceedingly important Northwest

resource. Their work, as embodied in a series of drainage basin reports, illustrates the key importance of coordination in planning.

Public investment in water resource development has been greatly stimulated in the effort to find construction opportunities to take the place of the dwindling stream of private construction. This is likely to continue for some time. Water resource projects therefore need not only ample physical data and correlation of engineering plans for different uses, but standard criteria of economic and social value. It is at this point that the greatest weakness of water planning activity occurs. When is a flood control, irrigation or navigation project economically justified? This is a question that may defy complete certainty of answer; but it deserves much more fundamental consideration than it has thus far received. I do not think the water planning agencies are adequately staffed to give such consideration. Lacking such analysis, projects may be given priority upon the basis of hunch or pressure.

Of the four states, Montana has probably done the most effective job of water planning. Its critical situation in the farming area east of the Continental Divide and in the mining centers called for speedy action, not only to relieve the acute distress of thousands of drought farmers and unemployed miners, but to save whole communities. To furnish opportunity for many of these folk it has both planned and developed many small irrigation projects and has assisted the livestock industry with stock-watering projects. Similar efforts have been directed toward a like, but less acute, situation in Idaho and eastern Oregon.

I can merely mention the successful achievement of a plan for rehabilitating the Sockeye salmon industry of Puget Sound—a plan now embodied in international treaty and ready for fulfillment. A comparable interstate program for restoring the dwindling salmon industry of the Columbia River system has been proposed by the planning boards.

Let me close this truncated list of water resource plans and problems by briefly reviewing the hydro-electric power problem. Bonneville

is now generating electric energy. Grand Coulee will soon come in. The proposals for making these great resources available upon a regional basis, which were made by the Regional Planning Commission in its 1936 Columbia Basin report, have already borne fruit in the design and partial construction of a regional grid system. This will tie the major energy producing centers into a super power network. The rate policy adopted has likewise followed the regional objectives proposed by the Commission. But the administrative organization for transmitting current was set up on an avowedly temporary basis. It is still too early to fully appraise the adequacy of the temporary organization in all respects, but it is already clear that there are some deficiencies in its structure and powers.

With regard to structure, it needs (1) to be clearly tied at the national level with similar operations by the federal government in other parts of the nation—notably with the T. V. A.; it needs (2) an organic tie into the regional planning structure; (3) it needs a corporate foundation so that the continuous challenge of the financial balance sheet will confront it and so that its work may have the flexibility implied by corporate powers. The entire operation will stand in annual jeopardy so long as it is treated like a bureau and may have its operating appropriation blocked by a single member of the triune combination that must move in unison to adopt a national appropriation statute.

Both the T. V. A. and Bonneville administrations are confronted with the task of maximizing the use of their energy supplies. Each must find this objective in enlarged rural, domestic and industrial uses. T. V. A. has already found it necessary to explore new opportunities in each of these fields and has consequently developed a considerable research organization for these purposes. Already these activities have yielded a new process for producing phosphate fertilizer, new and cheap appliances for agriculture, new low cost units for home refrigeration and cooking. A close working relationship between these two great nationally financed regional power producing agencies is indispensable

if the maximum advantage of their resources and experience is to be of public benefit.

At present Bonneville is without legal authority or funds to engage in the research and experimentation that already seems to be essential to the fulfillment of its purpose. Until it is clothed with such authority the huge power investments of Uncle Sam upon the Columbia will be menaced. Since major outlets for retail distribution are likely to be publicly owned systems, the methods of aiding such units with technical and managerial advice and service should be as effective as possible. The public utility districts for local distribution have little or no experience in managing distribution systems. The success of their enterprise and of the whole federally owned system of generation and transmission can be seriously impaired unless they are given continuous advice on techniques and management for some years to come. This is another reason for the close interchange of staff, knowledge and experience between Bonneville and T. V. A.

The preservation of the Columbia Gorge from defacement by industrial and urban developments is an objective which the Regional Planning Commission has sought and which has enlisted the earnest support of thoughtful people throughout the Columbia Valley. A great deal of detailed data have been assembled, specific items for a comprehensive plan for conserving this unique asset have been set forth. Even from the standpoint of economic and social efficiency the disadvantages of the Gorge for major industrial development are patent. The limited land area suitable for factories and towns places so high a premium upon space that overcrowding on the level areas and defacement of the slopes can hardly be prevented should such industrial growth be allowed. The climatic conditions—wind, sleet and rain—are much more unfavorable than they are in the level areas to west and east. Nevertheless, despite the assembly of these facts and their publication, no program for preventing the destruction of scenic assets or avoiding the wastes of unplanned towns within the narrow Gorge has been given

effect. The shack town of North Bonneville and the crowded workmen's cabins that erupted like an eczema over the fair face of valley and hillside during construction are likely to remain as unsightly evidences of the limitation of foresight and the gap between planning and action. The failure of the Washington and Oregon legislatures to create a joint agency to control community development in the Gorge means that nothing can be done for at least two years unless the Bonneville Administration is given additional powers to fill this gap.

4. Economic Opportunities for Migrants

The central theme of this Conference is the problem of migration into our region. While this has been popularly identified with the exodus of farmers from the "dust bowl" and the drought areas of the northern Great Plains, it is a larger movement than that. The most significant sample of this migration has been collected by the Oregon Planning Board covering the period 1930-1937 and including over 115,000 persons. Some of the conclusions drawn from this sample are:

a. A large proportion of the immigrants came from states outside the dust bowl.
b. For every two persons entering the state one departs.
c. Migrant families with children average more children per family than resident families.
d. But the proportion of single persons among migrants is increasing.
e. Less than forty per cent of the immigrants were farmers or rural workers.
f. One-half of the migrant workers had pursued eight occupations, as follows: Laborers, truck drivers, farm hands, salesmen, carpenters, operators, farmers and mechanics.
g. More than half the migrants did not seek farms or rural employment but went directly to cities.
h. While most migration was along parallels of latitude, from east to west, important movements of migratory farm laborers up and down the Pacific coast are affecting Oregon.

The size of this sample is sufficient to make it very significant. It is probable that the story it tells will hold true in the main for Washington. It will have less validity for Idaho and still less for Montana. While Montana may need to concern itself chiefly with reducing but stabilizing its east side economy into a combined range and farming program and finding new farming units on the irrigated valleys of the west slope, the other three states are confronted with a much more complicated situation. Oregon and Washington cannot view migration as primarily a problem in agricultural opportunity. On the contrary, the recent and current migration is simply making more acute the problem of employment of every kind, farm and non-farm.

The farmer segment of the problem is certainly acute and important, as shown by the fact that of one sample of over 20,000 farm settlers only about one-quarter had been able to locate upon a going farm while the rest had either occupied formerly abandoned farms or were trying to get a start on unimproved land. This situation certainly points to the urgent need to accelerate the rate of basic land studies, to bring in new areas of good soil through clearing, drainage and reclamation, and to do this speedily and at low cost.

But the even larger problem is that of finding opportunities in industrial and urban employment. The industrial economy of the Pacific Northwest presents grave difficulties which I can only briefly outline. Eighty-five per cent of the freight shipments from the region consists of agricultural and forest products, while seventy per cent of the tonnage brought into the region are manufactures. This means that basic industrial employment is largely confined to the extraction and processing of farm and forest products, with mining and fishing offering small additional opportunities. The result is a highly seasonal employment situation subject to marked cyclical variations. Moreover the seasonal peaks and valleys in agriculture and forestry tend to coincide, so that the seasonality difficulties are reinforced with small chance of amelioration through dovetailing. A study of seasonal fluctuations in fifty-four

different kinds of Oregon industries for the five-year period 1931-1936 shows Oregon seasonal fluctuations are over twice as great as those for the United States as a whole, ten times as great as for Great Britain, and nearly two and a half times as great as for Pennsylvania.

The Oregon Unemployment Compensation Commission has discovered some of the extreme irregularities of industrial employment since it began the payment of benefits. Because the first year of benefit payment (1938) coincided with a cyclical slump, seasonality and cyclical factors are intertwined. Yet it is significant that during that year there were paid to unemployed men in the logging industry more than three times as much as had been contributed during 1936-1937. For the basic lumber industries (sawmills, etc.) the benefit payments were 159 per cent of the contributions, and for finished lumber products 154 per cent. Nor does this reflect the full character of the seasonal employment difficulty because the benefit year upon which legitimate payments are based is not the calendar year, but the seasonal year or the seasonal period fixed as that part of the year for which the industry is normally expected to operate. This situation is doubtless duplicated in Washington, and probably in large degree in Idaho, but to a less extent in Montana.

This industrial pattern into which the migrants come requires that any projected solution be not worked out for them alone. Their problem is the general regional problem of increased year-long employment. This means that public policies relating to industrial and land development should be directed largely to this end. Let me note one point of caution for land development. It will be a doubtful social service to irrigate more land for such crops as sugar beets which, the experience of other regions indicates, will not only demand the equivalent of a very costly national subsidy, but will require a migratory labor force of men, women and children, at a most meagre wage, for five or six months of the year. In those areas they create problems of health, education, housing and relief that are almost insoluble.

Caught between the low prices of specialized fruit crops, high freight charges and the need for a large supply of migratory farm laborers for a short period of the year, the hop and berry growers and the orchardists of the Northwest are in the unenviable position of having to skimp on wages, housing and sanitation. The great range in labor needs for this open air industry is shown in the Yakima Valley where the requirements vary from about 500 in late winter to over 32,000 in the September harvest peak. This situation presents a challenge to the inventiveness and sense of human decency of the communities affected and of the planning and operating agencies.

When the issue of trying to increase stable industrial employment is faced, it seems clear that unless governments are to supersede the private entrepreneur, the problem can be approached by governmental agencies only obliquely. From this standpoint, I see about four lines of action.

First, the traditional competition of local Chambers of Commerce, Port Commissions and City Councils for the location of industry (which has long since needed moderation through a code of fair competition) should include at least the following general principle: Encourage only those industries that offer a decent annual income to the new labor force and deny aid to those enterprises which in effect ask the relief agencies to keep in "cold storage" a supply of low paid labor to serve their seasonal convenience.

Second, harness the existing credit functions of the RFC to stabilizing the forest industries on a sustained yield management basis wherever possible, and to aid new industrial activities that offer a decent wage at steady work.

Third, seek the assistance of national authorities to determine whether private monopoly advantage is deterring the location of new industrial enterprise in the Pacific Northwest.

Fourth, expand governmental activity into the functions of research and experimentation. Here there are two possibilities meriting exploration. There is the chance that the work of the Forest Products Laboratory at Madison could be so amplified and directed toward the timber types of the Pacific Northwest that new wood products could be developed which would both increase employment and reduce the drain on our timber. The second possibility I have already hinted at. That is to expand the functions of the Bonneville Project (or its permanent successor) and the other appropriate federal and state agencies into the fields of industrial research and experimentation. When the two power installations at Bonneville and Coulee shall have been completed, the federal government will have invested possibly three hundred millions of dollars in electric power production and transmission. I have not included in this figure any estimate of the cost of the proposed Umatilla, or later hydro development projects which, if and when completed, will greatly swell this total. A private enterprise with such a huge investment would undoubtedly feel warranted in spending large sums in research and experimentation looking toward the complete use of its product. When to this federal investment we add the millions already invested in the municipal systems of Seattle and Tacoma, and the private generating investments not fully utilized, we have a total investment of around six hundred million dollars. The new federal system will be capable of supplying some one and a half million kilowatts of energy. This cannot be exported from the region except in the form of finished goods. It must be consumed locally either for domestic and commercial use, or for industry. "New industry comes out of the laboratory," said John P. Ferris in a recent address before the Georgia School of Technology. "Obviously scientists and engineers must uncover the opportunities. For this function, the great corporations turn to their own magnificent research staffs. In this manner have come rayon and cellophane from cotton and wood; Masonite from stumps on cut-over forest land; better enamels from soy-bean oil, and so on."

The federal agency charged with organizing the transmission of these vast pools of power should lead the way in finding new useful outlets for electric energy in all these fields. In pursuing such a function it would of course follow the example of private research organizations and other public research practices (such as those of the U. S. Public Health Service and the T. V. A.) in enlisting the efforts (frequently by financial aid) of the research staffs of other federal and state agencies, and the colleges and universities. It would also be sound policy to invite other public and private owners of capital investments not fully developed or utilized to join in financing and guiding this research and experimental work. The long range interests of federal, municipal and private power agencies are tied together in the need to expand the use of electricity. On this one objective they should either hang together or they will, in Franklin's phrase, "hang separately." In the development of industrial experimentation, maximum use of power combined with maximum well paid employment should be a joint objective. Some of the possibilities both for new industrial enterprise and new rural consumption are shown by work already accomplished or under way in the Tennessee Valley. There the accomplishments in research and pilot plant development in phosphate fertilizer production, and in a new frozen pack process applicable to berries, peaches and vegetables are even now demonstrably successful in starting new industrial enterprise. The research of the state universities and technical schools in cooperation with the T. V. A. is already full of promise for small new industrial improvements in many directions. These federal hydro enterprises will more certainly promote fuller employment and other social gains if the Bonneville Project, when permanently organized, is integrally tied into the Regional Planning Commission. The various state and federal agencies represented thereon, when it is fully developed and implemented, would furnish a constant reminder to the Administrator to keep in mind the whole welfare of the regional population. This is an important objective in planning organization.

THE NEED FOR NATIONAL PLANNING

Perhaps in what I have said thus far I have gone some distance beyond the potentialities of state and regional planning in our kind of social organization. I am acutely aware that very real limits to the scope of regional and state action are set by the pattern of national and international policy. What can be done within the Pacific Northwest to assure our people, and those who are coming here, of a more secure and ample life depends upon many decisions made outside the region. We alone cannot create markets for wheat in England, Italy, Germany or the rest of Europe. We cannot send our apples, prunes, and other fruits abroad if the people there do not order them. We cannot keep our logging camps and mills busy if the farmers and urban workers of America cannot afford to buy the lumber for barns and houses. We cannot stop the wholesale displacement of the share-cropper by mechanical equipment which is now setting him upon the highway headed toward the Pacific Coast. We cannot restore the national birth rate, or let down the bars of immigration to America, or expand the opportunities for private capital investment abroad or (save possibly in the limited ways just enumerated) at home.

If we have entered a new phase of economic life, when our capitalistic economy has ceased to expand, as many of our economists insist, the lot of our farmers and urban population is indeed insecure unless national policy is adapted to meet such a new situation. If, as Alvin Hansen contends, full employment cannot be sustained without a large, steady stream of new investment, and if private investment outlets on a sufficient scale cannot be found in a non-expanding economy, then the Pacific Northwest and every other region will be unable to find jobs for its people until a substitute for this stream of private investment is found. I hope that this substitute will not be sought in a huge armament boom, or through the reduction of the labor pool by the slaughter abroad of millions of our young men.

It is to questions like these that a national planning agency should address itself. Here regional and state planning of the future will require the guidance of a planned national policy. What that policy will be will depend only partly upon the adequacy of planning organization and staff, at every level. In the last analysis it will rest upon the wishes of the public and the quality of political leadership which represents it. As a part of that public we of this region should seize every opportunity to inform ourselves of these basic state, regional and national problems and express our judgments to our public representatives through every legitimate avenue.

NORTHWEST REGIONAL COUNCIL

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OBJECTIVES OF NORTHWEST REGIONAL COUNCIL

1. *To stimulate a greater public awareness of the basic problems of the Pacific Northwest.*
2. *To make available at all educational levels accurate and stimulating materials concerning the social, economic and governmental problems of the region.*
3. *To provide the machinery for conference and consultation among the advisory, research, planning and educational agencies concerned with the orderly development of the Pacific Northwest.*
4. *To foster coordinated research in the natural and human resource fields so that wasteful duplication may be avoided and new fields for constructive research may become more clearly defined.*
5. *To act as a clearing house for the interchange of bibliographic and other technical data of regional significance.*
6. *To make known the training required and opportunities available for career service in the various agencies of Federal, State and local government. To encourage the extension of sound public-service training facilities.*
7. *To assist by means of publication and grants-in-aid specific research of a highly significant character and primarily regional in scope.*

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SUMMARIZED SAMPLE SURVEY OF NATURAL RESOURCES BASED ON THE TOWN OF HOLDEN AND VICINITY

Prepared by the

CONFERENCE ON LAND ECONOMIC SURVEY*

Published by the
MASSACHUSETTS FOREST AND PARK ASSOCIATION

For the past three years the Conference on Land Economic Survey has been engaged in an effort to extend the scientific knowledge of the natural resources of the Commonwealth in order that they may be conserved and developed with greater efficiency. This effort however did not bear fruit until last year, when the General Court directed the Department of Public Works to study the need for such information and report its findings to that body. While that study was in progress the Conference arranged for the making of a sample topographic resurvey of an area in the vicinity of the Cape Cod Canal covering about 30 square miles. This was done by raising a fund of $2,520 by private subscription which was donated to the State. An equal sum for this purpose was then contributed by the Federal Government and the survey was made by the U. S. Geological Survey. The high quality of the sample map compared with the old topographic survey maps of the same area was convincing proof that the Department of Public Works alone would make large savings in preliminary surveys if such maps were available for the whole state. Therefore it recommended that the General Court authorize a complete resurvey of the State, and that the State's share of the cost be taken from the Highway Fund. This recommendation was adopted and the survey, which will require from seven to eight years, was begun this past summer.

The Commissioners of Public Works also held hearings on the need of a land economic survey at which officers of the Conference presented the subject. In the report on this matter a land economic survey was recommended and a bill calling for the creation of a special department in the

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* The Conference on Land Economic Survey consists of representatives from universities, colleges, state departments, and civic, scientific, educational and commercial organizations. These representatives are active leaders in the fields of agriculture, business, biology, economics, engineering, forestry, geology, geography, public health and town and regional planning. The Conference was the result of a meeting of these interests called in December 1930 by the Massachusetts Forestry Association, now the Massachusetts Forest and Park Association, to consider the need of greater knowledge of the natural resources so that their use might be more logically planned.

State College for this purpose was filed with the General Court. This bill was passed by the Senate but it was referred to the next annual session by the House, on the ground of economy.

In the meantime further study by the proponents of the bill, shows that this work can be done by the college through an existing department, thereby saving the overhead cost of a new department. The expense of making the survey can be confined chiefly to the employment by the college of some extra technical and clerical assistants, and the publication of the information when assembled, coordinated, and put into a form for public use. The revised bill printed herein we believe will largely eliminate the objections raised by the House of Representatives.

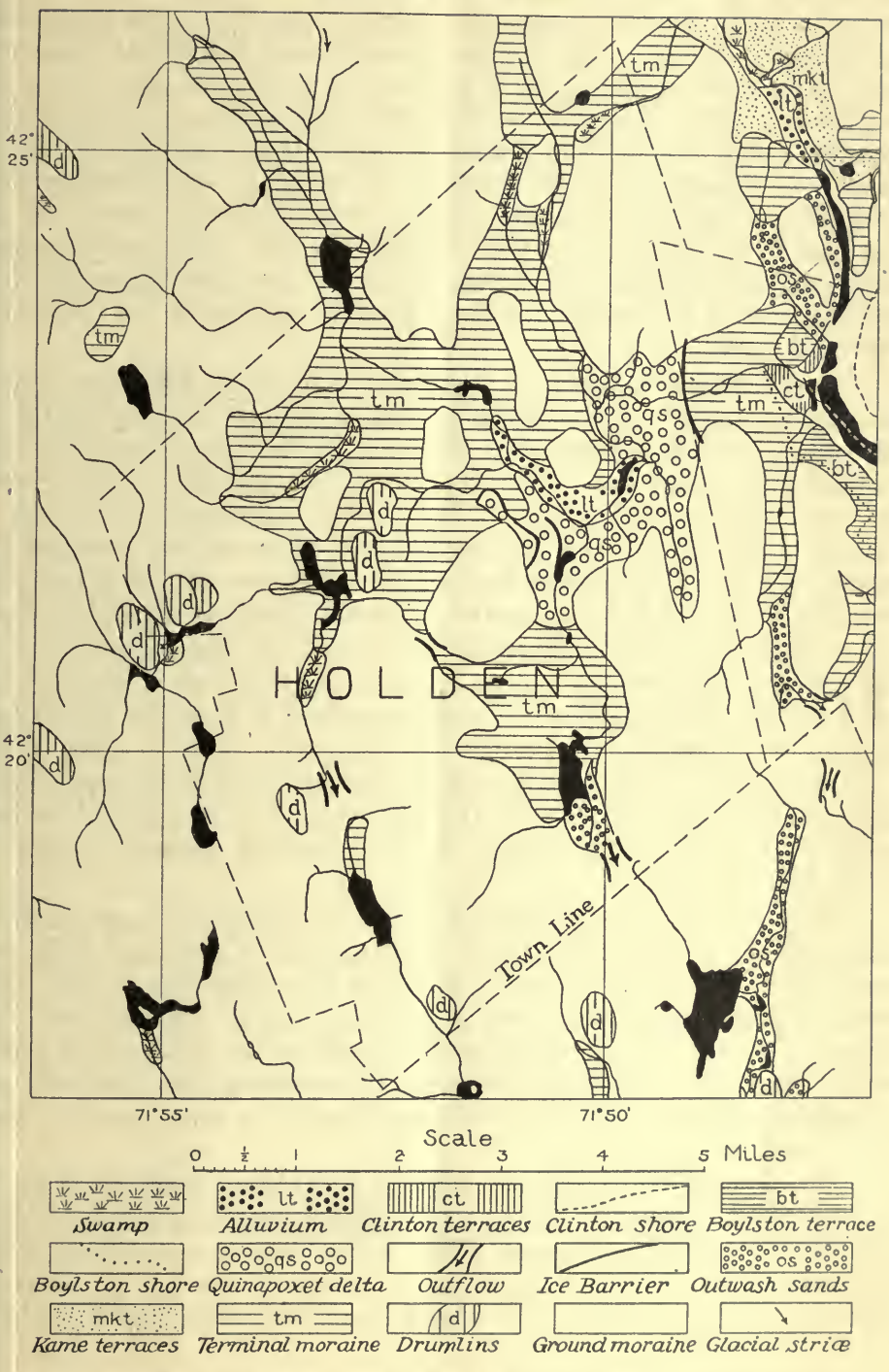
The Conference has now attempted to make a sample land economic survey of a limited area in order to show the value of such a survey to the public and to the individual citizens as has already been done by the sample topographic resurvey. The information contained in the following pages concerning the natural resources in the town of Holden was assembled through the cooperation of various departments of Harvard University, Mass. Institute of Technology, Clark University, Mass. State College and the Division of Fish and Game. Much of this data had been collected for educational purposes. The Conference, whose funds are obtained entirely by private subscription, is unable to publish in detail the reports on which this information is based but it submits them in condensed form. A deliberate field survey would give a much more complete and accurate picture of present conditions, which would enable the state, the town and individual land owners to devise long time plans and policies of development. Without the generous assistance of the above named institutions even this brief presentation would have been impossible and the Conference wishes to express to them its hearty thanks. Incomplete as this survey is we believe that the public will see in this effort the far reaching practical value of obtaining more scientific knowledge of the kind, quality and quantity of our natural resources.

GEOLOGICAL SURVEY

By Professor Frederick K. Morris,
Department of Geology, Massachusetts Institute of Technology.

Six rock formations are recognized in Holden. They are named in order from west to east, the Paxton Schist, the Brimfield Schist, the Fitchburg Granite, the Boylston Schist, the Oakdale Quartzite and the Worcester Phyllite, as shown on the map. In the complete report detailed descriptions

Soil Types of Holden



Data taken chiefly from Bulletin 760-B, U. S. Geological Survey, by William C. Alden

are given of how each of these rock formations were formed. Here it is enough to point out their important practical qualities. The finer schists and phyllites, including the Worcester and Paxton formations, cannot be used for concrete aggregate, road material, or dimension stone. But, certain beds of rocks, especially the Worcester have been used in the past as slate for roofing, and as tombstones, for which their slabby form, smooth texture and dignified dark color fit them. Grindstones were formerly made of some of the granular portions of these schists where the mixture of soft mica and hard quartz kept a good cutting surface. The more granitized portions of the Brimfield Schist may be used as concrete aggregate where very little strain is expected but not for large constructions or for heavy-duty road metal.

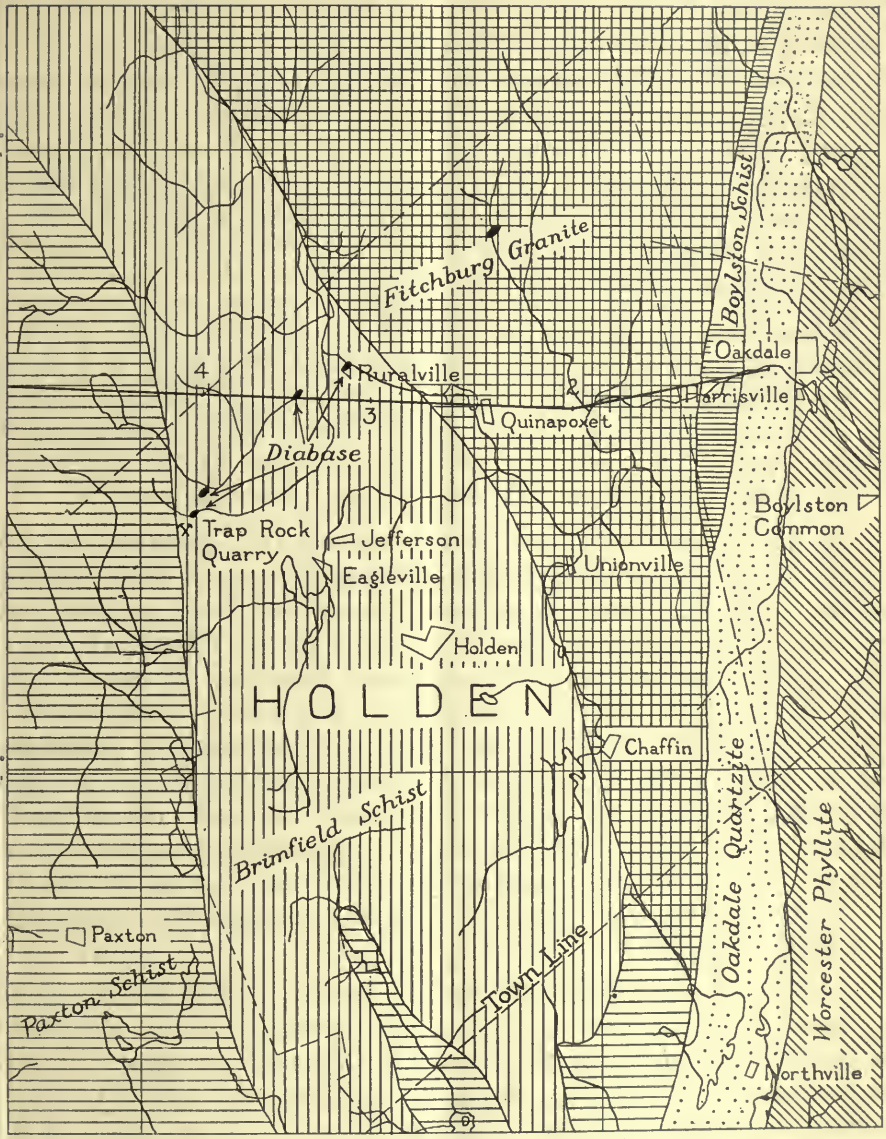
Of the six rock formations present in Holden, the Fitchburg Granite offers the most satisfactory source of concrete aggregate or of building stone. For the latter use, the Fitchburg Granite in the Holden area is generally more streaked and variable than it is in the Fitchburg quarries. These characteristics do not weaken it, nor do they, in my opinion, detract from its beauty. Many of the most popular granites are markedly streaked and variable. It is possible that in the future a vogue for streaked granite may bring the granite of Holden into the commercial field as a building stone.

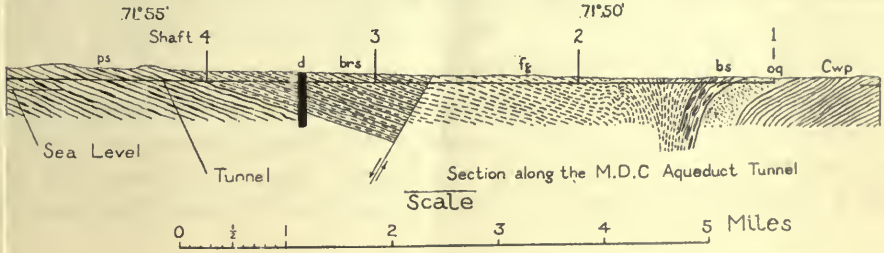
In the northwest of Holden there are a number of diabase knobs. Originally these rocks were hot liquids which ascended cracks in the Brimfield Schist and the Fitchburg Granite, and crystallized to form the dark, tough, strong rock commonly called trap. The trap-rock is easy to blast, though it is hard to drill. It can be quarried cheaply and is one of the best crushed rock types known to engineers. The southernmost of the knobs has been opened as a quarry; all of them can be opened as economic conditions justify their use.

During the Ice Age the glaciers scraped away the soil and weathered rock, until only fresh, sound rock was exposed. Upon this clean rock surface the melting ice deposited a thin sheet of boulder clay or "till" composed of boulders, pebbles, sand grains and clay all commingled. The mixture is spread over the solid rock, varying up to 35 feet thick and is called "sheet-till" or "ground moraine". It is a dense, firm, tight soil, easy to excavate. It yields but little well-water, and is a poor crop-soil except for forest growth.

At certain places the glaciers piled up the till to a thickness of several hundred feet forming low rolling hills called "terminal moraines". Here bedrock lies at an unknown depth, generally too deep to reach economically. The boulder-clay is easy to excavate by power-shovels but is extremely difficult to trench on account of its toughness and the abundance of boulders.

Geological Map of Holden





Data Furnished by Frank E. Tahlquist, Metropolitan District Commission

This is the soil that forces New England farmers to build stone fences. The terminal moraines yield ideal sources of material for earth dams, because till is the heaviest and one of the most impervious of soils.

Underneath the ice, till was piled up locally in the form of smoothly rounded hills, called "drumlins". They offer admirable sites for residences or hotels. Because of the impervious quality of till, many reservoirs are built in the tops of drumlins. Like the moraines, drumlins yield high grade fill and serve as storehouses for slowly moving bodies of ground water. The drumlins of Holden constitute a future resource, either for recreation-grounds, building development, or source of fill.

Water from the melting ice washed out sheets of sand, gravel, and clay which are gravelly near the moraine and become sandy and clayey as they are followed southward. They are favorable building sites for highways or homes. They generally contain freely moving ground-water at moderate depth. They may yield building sand and gravel, but are generally too variable to compete with that of kames, and lake terraces.

As the ice-sheet withdrew, rivers washed vast quantities of gravel, sand and clay, into temporary lakes, forming flat-topped deltas around the margins. New lakes formed at lower levels, and these in turn received thick and broad deposits of gravel, sand and clay. Three such lakes formerly existed near Holden and the present Wachusett Reservoir occupies almost precisely the site of one of them. The smooth level terrace-form of the deltas offers ideal building sites. Ground-water is abundant and freely-moving but this fact renders it subject to pollution; and the ground-water supplies in terraces should be carefully watched. The terraces are rich sources of gravel and sand for concrete aggregate but are less favorable for road-metal. The delta materials are very easy to excavate and can be used for the more porous parts of earth-dam facings; but cannot be used for dam-cores.

Some terraces were made of coarse gravels washed directly from the melting ice. They are called "kames" and generally contain coarser gravels and less sand and clay than the lake deltas. Kames are extremely porous, and therefore contain freely moving ground-water at considerable depth. Much of the kame gravel in the Holden area contains an unfavorably high proportion of schist and phyllite pebbles which are soft, cleavable and therefore undesirable for good aggregate.

Holden was selected for this survey, not for its outstanding mineral resources but because more of the geology was already known and funds were not available for new field-work elsewhere. Negative information in this field is frequently as valuable as positive since much money has been wasted

in futile attempts to find minerals which a knowledge of the geological formation would have prevented. In this state the savings resulting from a geological survey would be largely to the state and the towns in their engineering operations. Private contractors would also profit as well as owners of lands containing valuable stone, gravels, ground-water or other minerals. Public health would benefit from a knowledge of the available water supplies.

Massachusetts has never made an economic geological survey because it does not have an official geologist although three-fourths of the States now maintain geological surveys. The value of the mineral products of this state now averages about $16,000,000 annually, which sum would most certainly be increased by such a survey. Much money has been spent by the federal government for this purpose, which goes to other States because we have no official geological agency with which it may cooperate.

FOREST SURVEY

By Richard T. Fisher, Director, Harvard Forest

The map of present land use in Holden, based on airplane photographs shows that 83 per cent of the total area consists of forests, cut-over land or old fields reverting to brush and trees. Compared with a survey made by the State Forester in 1916 when 65 per cent of the town was covered with forests of various types and ages, we find that nearly one-fifth of the total area has reverted to tree growth in the past 17 years. The area used for industrial and residential purposes is now six times as large as in 1916, and that devoted to water protection has nearly doubled. On the other hand the land in tillage and open pasturage has been reduced by more than one half.

Many of the residences belong to people who work in Worcester and who engage in part-time farming, a permanent activity which promises to increase in this district. The reservoirs and the areas needed for protection of water supply comprise another type of permanent land use. And finally, with so large an urban population nearby, recreation, including hunting and fishing, has become an important land use.

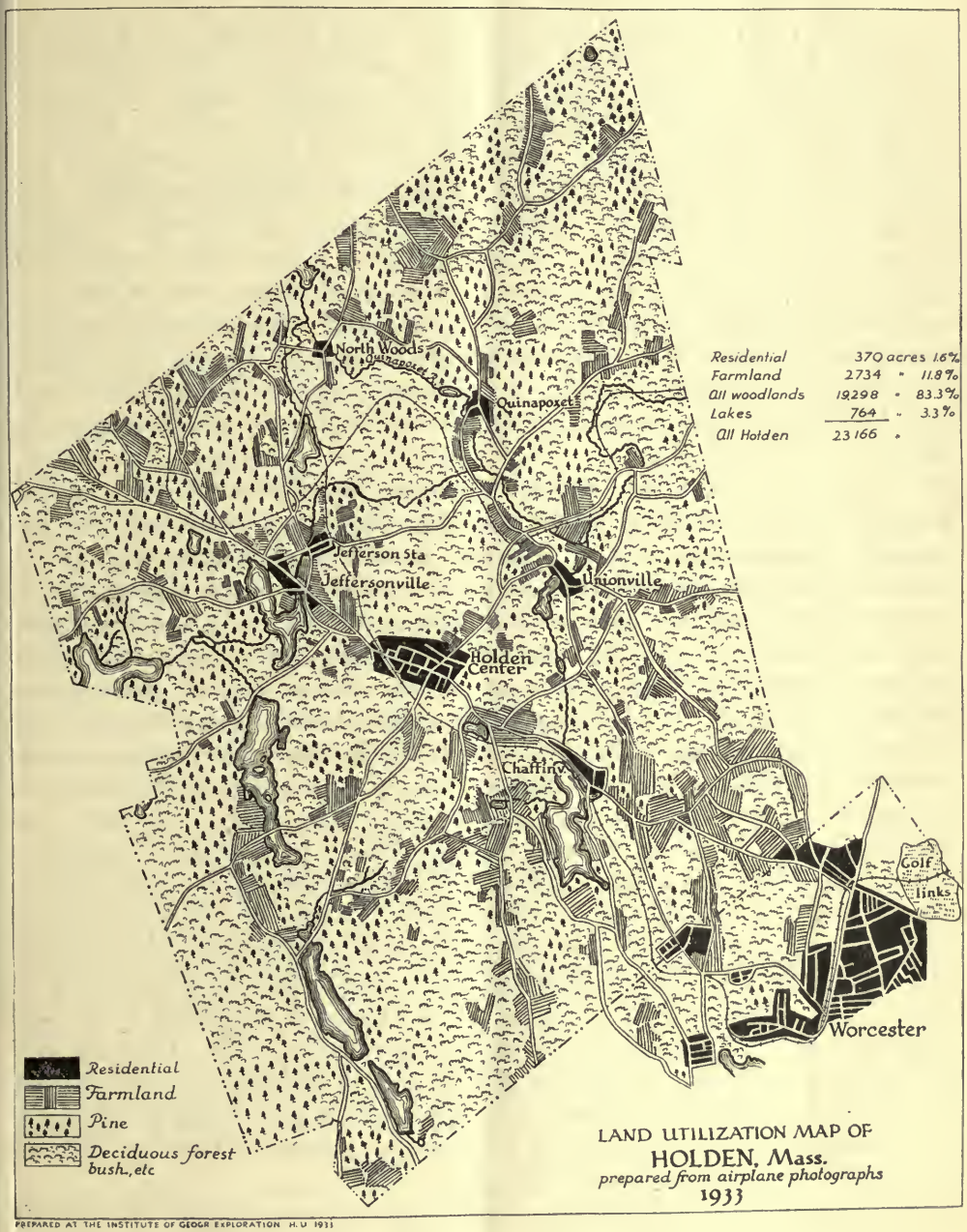
When all the areas, more useful for these and other purposes by virtue of soil fertility, topography, or proximity to roads or railways are

segregated, there still remains a large part of the town that is best suited to forest production. Much of this land is hilly or rocky on which the timber at present is of poor quality due to fires, neglect or over-cutting. For the most part, these wild lands now have a low tax valuation simply because they contain little or nothing of commercial value. On the other hand most of them are capable of growing a good crop of wood and timber without interference with their recreational, game-protection or water-conservation uses, if placed under forest management.

A plan by which this land might be set to work producing timber could readily be devised from a general economic survey. Such a survey would show which areas ought to remain as farm woodlots and which would better be in public ownership as town forests, state forests, game refuges, or parks. The plan would give due consideration to all of the natural advantages of the land and public knowledge of these advantages or disadvantages as the case may be, would help to prevent haphazard and often conflicting land developments in the same neighborhood. It would insure the maximum return from these lands, as well as the highest real estate values. These idle lands are not now contributing their possible share to the support of the community.

As a means of obtaining accurate information on large areas quickly, no method has yet been devised that compares with aerial photography either in cost or efficiency, as has been demonstrated in this sample survey. Aerial photographs are of use not only in forestry but in most work connected with natural resources. We, therefore, earnestly recommend that aerial photographs of desirable scale be made available at least for the use of all public and semi-public agencies in order to accelerate the collection of needed information about the natural resources. These aerial photographs should be made in connection with the topographic resurvey.

When all of the lands of the State are scientifically classified as to their best possible uses, which would naturally follow a survey such as has been made for Holden, the public agencies and the private owners could then establish long time policies of development. We could then go forward with long-time programs, such as are necessary in forest management, with the assurance that investments would be made on a permanent basis and to the best possible advantage. It is a well known fact that a large percentage of the land area of this State is idle or at best is yielding only a fraction of what it is capable of producing. If put to work in its highest productive capacity, the real estate value to the owner will increase and the public will benefit both from the material created for industrial use and in the increase in taxable values.



PREPARED AT THE INSTITUTE OF GEOGR EXPLORATION H.U 1933

FISH AND GAME SURVEY

By Harris A. Reynolds

Secretary, Massachusetts Forest and Park Association

At the request of the Conference, a biological survey in relation to the fish and game resources of Holden was made by the State Division of Fish and Game. It is not possible to print the detailed results of that survey in this brief bulletin but they may be seen at the office of the Division. The survey shows that there is a wide range of cover types, food supply and other favorable factors which makes Holden a potentially productive area for small game animals and birds. On the other hand, of the 19 named streams less than one-third are capable of being successfully stocked with fish. All of the ponds produce fish but more than 75 per cent of the pond area is water supply in which fishing is prohibited. It is obvious from this survey that owing to the intensive fishing and hunting on this area due to its proximity to a large center of population, it will not be possible to sustain the fish and game supply without the establishment of sanctuaries for both.

A survey of this nature on an area so small and isolated does not give adequate data on which to establish policies for the general region. For example, to determine whether a stream is worthy of stocking with fish it must be studied in its entirety, and some of the streams in Holden rise in other towns. The game covers in adjoining towns likewise affect the supply of game in Holden. But the value of this sample survey is not confined to the town of Holden; it rather demonstrates the desirability of such a survey for the whole State. For example, it is a well known fact that ever since the state began to raise fish and game birds for stocking purposes, large numbers of fish have been lost in the stocking of streams, in which it was impossible for the fish to survive and establish themselves. The same condition prevailed in the stocking of covers unsuited to the natural reproduction of the birds and animals liberated though perhaps in lesser degree. The reasons for these losses were due to the fact that the Division did not have the means of procuring the desired technical information in advance of stocking, together with the demand of local sportsmen that they be given a share of the birds and fish produced by the Division regardless of whether conditions for liberation were entirely satisfactory. The Division now knows that more than two-thirds of the streams in Holden are impracticable or at least doubtful for successful stocking and it knows the streams that are desirable for this purpose. Therefore the sportsmen's money will not be wasted in futile stocking in that town.

To anyone who considers the desirability of bringing our streams and forests to their maximum production of fish and game, this survey prompts

a review of the whole problem. The State claims the ownership of all wild life and therefore it belongs to the people as a whole. Yet the State has completely neglected this valuable resource except for the passage of laws regulating the taking of fish and game, and the fixing of license fees for fishing, hunting and trapping. The money obtained from these licenses is practically all that has been spent in the conservation and propagation of wild life. Only 115,000 licenses were sold in 1933, which means that less than three persons in 100 of the total population fish or hunt legally. It is inconceivable that so few would fish and hunt if fish and game were plentiful. Besides the value of food and fur from this resource would be greatly increased.

We have scarcely begun to establish sanctuaries for our wild life where natural propagation may be encouraged as has been done so successfully in Europe and in some of our sister States. Little search is needed to disclose the reason. Those who supply the capital for an enterprise usually have a controlling voice in its management and our system of wild life management is no exception to that general rule. The organized part (less than 25 per cent) of our licensed hunters and fishermen have quite naturally demanded immediate improvement in fishing and hunting which has resulted in the application of temporary measures instead of adopting the surer but long-time policies. Since, for example, it costs more to raise two pheasants than a hunter pays for his license and since that hunter may take six pheasants and other game on his license it is unlikely that much progress can be made in permanently stocking our covers under that system. When fish of legal size are placed in the streams and the fishermen are permitted to catch them before they have become established, it may satisfy the few who get to the streams first, but this method will never restock our streams.

It has been demonstrated again and again that wild life can be reestablished in a district if favorable conditions are maintained and if we have inferior fishing and hunting in this State it is because we have been unwilling to tackle the problem scientifically. Wild life is a natural product of our forests and streams but it must be managed intelligently. From the economic standpoint we have in this wild life an opportunity to increase our natural wealth and to procure the commercial benefits that come to the people as a by-product such as the attraction of tourist trade. The States of Vermont, New Hampshire, and Maine sell annually many thousands of hunting and fishing licenses to residents of Massachusetts. Apart from the fees collected from the sale of these licenses, huge sums are spent by our citizens annually in those States for these forms of recreation. With good fishing and hunting in this State, much of that money would remain at home and especially in periods of depression when it is most needed.

A resource that belongs to the public should be so conserved and managed as to give the maximum benefit to the greatest number. The least therefore that the public can do to obtain those benefits is to determine the possibilities of the resources and eliminate waste. The sample survey fully demonstrates that the cost of making such a survey for the whole State would in a very short period be completely offset by the savings alone in the stocking of streams and covers.

But the biological survey would not only determine what streams are adapted to the natural production of fish and what areas are best suited for game production, but it would determine the streams and ponds that are now pure, those slightly polluted that may be reclaimed and those that are polluted beyond economic redemption at this time. Pollution is increasing steadily and the only way to check its advance is through the adoption of a policy for the protection of the purity of the waters of the state. This cannot be done intelligently without the scientific facts on which to establish a policy. Not only is such a survey essential for the successful natural propagation of fish, but for the encouragement of all forms of recreation on our streams and ponds and the protection of the public health. The general public should therefore take the initiative in this program. It should not depend in so important a matter, upon the isolated surveys that the Division of Fish and Game may be able to make from time to time with its limited funds. In our efforts to find new sources of income we instinctively turn to our natural resources and here is an opportunity to improve our recreational facilities, create natural wealth, protect public health, and at the same time conserve and develop a neglected resource. The proper solution of the fish and game problem in this state will be equivalent to the creation of a new and profitable industry and the benefits will accrue to all the people.

THE PROBLEM OF LAND UTILIZATION WITH SPECIAL REFERENCE TO HOLDEN, OAKHAM, AND NEW BRAINTREE

By Dr. W. Elmer Ekblaw, Department of Geography, Clark University and Dr. David Rozman, Department of Economics, Mass. State College.

In planning the efficient use of natural resources, primary consideration should be given to the problem of land utilization. A hundred years ago, most of the small towns in Massachusetts were flourishing agricultural communities in which farming was supplemented by small-scale industrial activities prevalent at that time. With the development of transportation facilities, technical changes in production, specialization by sections of the country, and increased competition, many old opportunities for indus-

tries in Massachusetts towns have disappeared, although in their place some new ones have arisen. Adjustment to new conditions in general has been slow and has proceeded largely by trial and error. Very little in the way of efficient planning has been done to prevent the waste of human and natural resources. The greatest waste of all is found in the presence throughout the state of many idle acres of land which place an unnecessary burden on the local communities and on the taxpayers of the Commonwealth. In 1880 about two-thirds of the total area of the state was occupied by farms, while in 1930 this area had dwindled to only 39 per cent.

Studies of the Massachusetts State College indicate that most of the land which went out of farming is at present owned by non-residents of the towns and is not being utilized in any productive way. There are at the present time 118 towns in the state whose acreage in farms is less than 25 per cent of the total town area. In 54 towns the average proportion of improved land on the farms is less than 25 per cent, signifying that much of the land is of inferior quality for the raising of agricultural crops, and therefore remains idle. This is reflected in a condition where the average value of farm land per acre is below $25.00 in 72 towns, and below $15.00 in 34 towns. The land released from agriculture and not devoted to other purposes causes depopulation of the towns with the result that in 92 towns less than 50 persons are found on a square mile. In these towns the expenditures for schools, roads and other improvements are greater than the return in taxes, and the treasury of the Commonwealth is burdened with the necessity of covering the deficit.

To eliminate this waste and to put large areas of idle land into productive use it is essential to promote efficient planning on the basis of accurate information. The consideration of the physical conditions of individual towns and their economic opportunities will indicate just what kind of policy should be pursued in individual cases. To show a specific example in planning it is worth while to consider the results obtained by Clark University in its study of land utilization in three towns, Holden, Oakham and New Braintree, all of Worcester County, which illustrate the necessity of application of different policies on the basis of knowledge of local conditions.

The towns of Oakham, and Holden offer only a limited amount of land suitable for agriculture under present conditions; therefore large areas which formerly were farmed are now idle land. Only 50 per cent of the land area in Oakham is now in farms, while in Holden it is about one-third. In Holden alone there are 12 miles of road formerly used and now abandoned. The major portion of land in Oakham is now in woodland, which, except for a small area owned by the State, is entirely neglected and does not bring any adequate return, either to the owners or to the community.

The population of this town has steadily decreased until now it is less than one-half of what it was a hundred years ago. A scattered population, large areas of idle land, low land values, and loss of income from taxes make it extremely difficult to maintain local institutions and roads without substantial assistance from the State. The natural conditions and economic prospects for such a town indicate that the best utilization for its land areas is in the growth of trees. It would be wise planning to extend here the area of land in State forests or managed forests owned by private or public agencies. New settlement for agricultural purposes should be discouraged and opportunity given for the remaining farmers to move out on the land in neighboring communities with greater promise for agricultural development, except that enough of the best farmers on the best farming lands accessible to market should remain to supply local needs and any recreational or resort market that may develop.

The conditions in Holden, on the other hand, indicate that not all of the towns with poor soil and rough surface unfavorable for agriculture are falling into decadence. The favorable location of this town, together with good new roads, promoted the development of new uses of land largely for recreational, residential and part-time farming purposes. The latter use especially has shown considerable increase within recent years. An investigation of the Massachusetts State College showed that almost one-half of the total agricultural output of this town has been produced by people engaged in part-time farming. The population and the number of buildings in this town have been rapidly increasing with the development of motor transportation and the settlement of people employed in the city of Worcester. In addition, large areas of land were taken up both for the Worcester Water Supply and for the Metropolitan District. Because new uses of land are constantly taking place the main problem of planning in towns of this type is to recognize their development and provide facilities for their orderly expansion.

In the town of New Braintree 85 per cent of the total area is in farms, with no perceptible decline in the amount of agriculture over a period of years. The total amount of woodland is only 25 per cent of the area of New Braintree, while the average for all the towns of Worcester County is 57 per cent. This low percentage of forested land is due to the fact that New Braintree is located on a belt of soils better suited to agriculture than most of the sections of Worcester County, and it is thus more profitable to produce cultivated crops than timber. New Braintree throughout its history has been predominantly an agricultural town and is likely to remain so for a long time. In a town of this type the problem is to encourage a more

intensive utilization of the land already occupied, and new settlement for agricultural and recreational purposes.

The foregoing brief analysis indicates the possibility of laying down certain fundamental principles of land policy. Many outlying farms on marginal land in this state do not show a profit, but the owners must hold on because they cannot liquidate their investments. On the other hand the cost to the State and to the town to maintain the roads leading to these isolated areas and to transport the children to schools far exceed the taxes from the farms and in some cases the net profit from the farms as well. Would it not be better for the farmer and for the public if the State or the town would acquire the farms of this type that are for sale and turn them into State forests, or parks? Certainly much of the land in these abandoned and semi-abandoned farms will show a greater net profit from tree production than from farming. In fact the purchase of such farms by the public has already been done in certain places to the advantage of both the farmer and the town. A survey of land utilization would undoubtedly show that this condition exists in greater or less degree in a large percentage of the towns in the State.

The discovery, tabulation, correlation and practical interpretation of all the scientific data concerning the natural resources would enable the State to assist the individual, the town and the State itself in the more efficient development of these resources. The resources and their possible uses should be made known so that the state may advertise them to prospective users within and without the State. Such information would enable the Commonwealth and the towns to plan their development along logical lines. A classification of lands as to their best possible permanent use for the greatest good of the largest number would pay for itself many times over in public and private savings. Such classification would not be used to compel the individual owner to follow any prescribed course in development but rather to safeguard him against the waste of money in unprofitable undertakings.

Contributions to this work should be sent to the

MASSACHUSETTS FOREST and PARK ASSOCIATION

3 Joy Street, Boston.

PROPOSED BILL FOR SURVEY OF NATURAL RESOURCES

House No. 260.

An Act to Provide for Scientific Surveys to determine the Geological, Biological and Other Natural Resources of the Commonwealth.
Be it enacted, etc.

Chapter seventy-five of the General Laws is hereby amended by inserting after section twenty-three the following new section.

Section 23A. The trustees shall undertake through such existing department of the college as they may determine, to make a land economic survey to determine the geological, biological and other natural resources of the commonwealth and they shall cooperate with other departments and divisions of the commonwealth, county commissioners, municipal authorities, educational institutions, and private agencies, in the collection and tabulation for public use of all available data in relation thereto, and to promote and conduct investigations for the classification and utilization of land and other natural resources.

Executive Committee

CONFERENCE ON LAND ECONOMIC SURVEY

Dr. Kirtley F. Mather, *Chairman,*

Department of Geology, Harvard University.

Dr. Alexander E. Cance,
Department of Economics,
Massachusetts State College.

Dr. W. Elmer Ekblaw,
Department of Geography,
Clark University.

Professor Frederick K. Morris,
Department of Geology,
Massachusetts Institute of Technology.

Professor Samuel C. Prescott,
Head of Department of Biology,
Mass. Institute of Technology.

Dr. Julia M. Shipman,
Dept. of Geology and Geography.
Mount Holyoke College.

Harris A. Reynolds, *Secretary,*
Secretary, Massachusetts Forest and Park Association.

3 Joy Street, Boston.
January, 1934.

STATE OF MINNESOTA

DEPARTMENT OF CONSERVATION

E. V. Willard
Acting Commissioner of Conservation

GENERAL SUMMARY of LAND CLASSIFICATION REPORTS for the ESTABLISHMENT OF STATE FORESTS AND CONSERVATION AREAS

GROVER M. CONZET
Director
Division of Forestry

February 1933

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FORESTRY | LANDS & MINERALS
GAME & FISH | DRAINAGE & WATERS
DEPARTMENT OF CONSERVATION

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CONSERVATION COMMISSIONER

DIVISION OF
FORESTRY
G. M. CONZET
DIRECTOR

ADDRESS ALL CORRESPONDENCE TO THE
DIVISION OF FORESTRY
OLD STATE CAPITOL

ST. PAUL, MINN.

Hon. E. V. Willard
Acting Commissioner of Conservation

Sir:

Although this report on land classification is brief with lack of detail as to procedure and findings, most serious thought and study has been given to the entire field.

Before a detailed and comprehensive long-time plan for forest administration can be evolved, it is first necessary that an inventory be taken of the stock and resources on hand. With this in mind, a land classification survey was made on nine State Forest Projects, in twelve counties, during the years 1931 and 1932. Data was collected on timber, cover, soil, topography, recreational possibilities, agricultural development, together with economics and other information which might serve to indicate the uses for which the land is best suited.

The surveys were made in areas selected because of the small acreage in farms, the large amount of state lands which were considered more valuable for forestry than agriculture, the large amount of tax delinquency, and regions known to be generally desirable for timber growing and conservation purposes. The selection of the location of these projects was largely influenced by the possibility of adequate protection and proper management.

This work has been carried on exclusively by members of the State Forest Service personnel during seasons when fires were not running. The men were also used as emergency fire crews, combining the land classification work with fire protection in the districts where they were located.

The crews on each forest project were under the direct supervision of a district ranger, with a technical forester assisting and responsible for collection of data and writing up the final report.

Strips were run one mile apart; mapping crews followed section lines insofar as possible, and offset when necessary to tie in type lines. Reliable control was established by making a plane table traverse of all passable roads and trails by cars equipped with special

STATE OF MINNESOTA FOREST SERVICE

PREVENT FOREST FIRES IT PAYS

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Acting Commissioner of Conservation

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speedometers registering units of 1/500 of a mile.

The economic inventory was gathered from court house records, county officers and settlers, covering land ownership, delinquency, taxes collected, bonded indebtedness, outstanding warrants, cost of operating school, average annual cost of construction and maintenance of roads within the area, and status of settlers.

With two exceptions all land classification activities were confined to regions where State lands have been withdrawn from sale for State Forest purposes and lands adjacent to these forests.

Detailed reports, accompanied by enlarged maps and charts, were compiled for each of the nine projects which are now on file in the office of the Director of Forestry.

Recapitulations of the nine reports, briefed to present the important, pertinent facts ascertained by the surveys are included in this report.

Respectfully submitted,

George M Cowgill

Director, Division of Forestry

February 20, 1933

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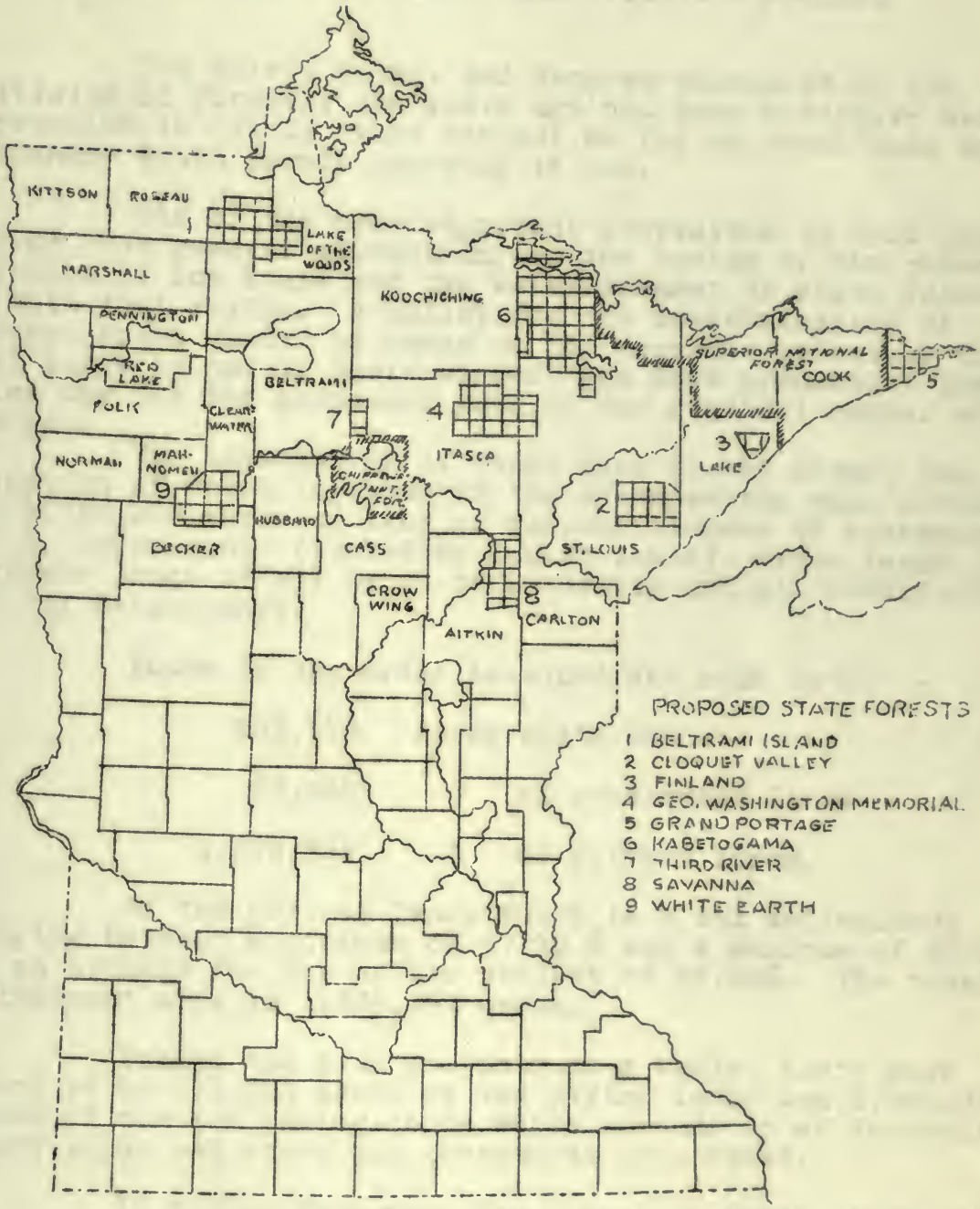
[signature]

Director, Division of Forestry

February 20, 1933


KITTSON
ROSEAU
LAKE OF THE WOODS
MARSHALL
KOOCHICHING
PENNINGTON
RED LAKE
BELTRAMI
SUPERIOR NATIONAL FOREST
COOK
POLK
CLEARWATER
ITASCA
LAKE
NORMAN
MAHNOMEN
CHIPPEWA NAT. FOR.
HUBBARD
BECKER
CASS
ST. LOUIS
CROW WING
AITKIN
CARLTON
PROPOSED STATE FORESTS
1 BELTRAMI ISLAND
2 CLOQUET VALLEY
3 FINLAND
4 GEO. WASHINGTON MEMORIAL
5 GRAND PORTAGE
6 KABETOGAMA
7 THIRD RIVER
8 SAVANNA
9 WHITE EARTH

FOREWORD

to the

SUMMARY OF THE STATE LAND CLASSIFICATION PROJECT

The Forest Policy and Program announced by the Division of Forestry two years ago has been effective and operative in nearly every respect as far as conditions and finances would permit carrying it out.

One of the most important provisions in this policy, aside from general protection, is the zoning of the cutover portion of our state and the establishment of state forests within that region. A policy for the administration of forest areas should be based on the economic principle that all lands be put to their highest and most productive long time use for the permanent good of the greatest number of people.

The examination of these nine forest areas, the location of which is shown on the accompanying map, included 2,355,000 acres of land of various classes of ownership,- U. S. Government, (including Indian lands), State lands, and private lands of all types of ownership and all conditions of tax delinquency.

Lands in the areas examined are made up of: -

283,135	Acres	state lands
80,452	"	of government lands
1,979,833	"	of private lands.

Of the private lands there is a tax delinquency ranging between a minimum of 47.10 % and a maximum of 82.37% or an average for the entire project of 65.98%. The total delinquent area is 1,306,351 acres.

Taking the nine projects as a whole, there were found to be 673,482 acres of tax paying lands and 1,669,939 acres of non-tax paying lands which is made up of tax delinquent lands and state and government properties.

In bygone days when the timber on these lands was of great value, and up to 1920 when the larger operators were rapidly cutting out, tax delinquency was negligible and of no consequence. Ample taxes could be raised for any

[illegible]

to the

[illegible] of the State game [illegible]

The Forest Policy and Program presented to the Division of Forestry [illegible] years ago [illegible] activities and operations in [illegible] years required [illegible] and finances would permit carrying it out.

One of the most important provisions in this policy-guide from general principle, is the setting of the [illegible] position of the state and the determination of state forests within that region. A policy for the establishment of forest areas should be based on the [illegible] principle that all lands be put to their highest and best productive use [illegible] time was for the permanent good of the greatest number of people.

The experiences of later days fully [illegible], the location of which is given in the accompanying map, [illegible] 2,320,000 acres of land of various classes of ownership, [illegible] U. S. Government, (including Indian lands), State lands, and private lands of all types [illegible] and all activities of the organizations.

Lands in the state [illegible] are [illegible] as of -

383,320	Acres state lands
90,400	" of [illegible] lands
1,846,280	" of private lands.

Of the private lands [illegible] is a [illegible] requiring [illegible] a maximum of [illegible] or an average for the entire [illegible] of [illegible]. The total delinquent area is 1,[illegible] acres.

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kind of local government and the municipalities therefore had almost unlimited credit. As a result in these areas examined they have bonded themselves in the amount of $296,327.54, which varies from nothing in some townships to nearly a dollar an acre in other townships. The total bonded indebtedness over the entire area was found to be $0.13 per acre, based on the total acreage of all ownerships.

Altho a few settlers are moving back into the cut-over area, the trend in the region studied is still abandonment. The cost of education per year in the areas examined varies from $54.13 to $255.00 per pupil. It is found that only about 3% of the total area covered in this survey is used for agricultural purposes and that only 41% of the income of the families listed as farmers actually comes from farm production.

There seems to be very little possibility that the income from the average farm over the area is going to increase. Findings indicated that 31% of the average individual income has come from forests and work dependent upon the forest. This was greatly reduced during the past years to where it now is and as time goes on, unless the forest area is properly handled, this income will be still more reduced, or wiped out.

An average of 28% of the income of the residents of these areas examined was from public funds, - U. S., state, county and township.

By a process of zoning for the purpose of establishing areas in which settlement and agricultural development shall be encouraged and those from which settlement should be discouraged and the present settlers gradually moved out, the cost of local government can be very materially reduced in the one place and the other greatly assisted by the additional help of the transferred settler.

Since 24.6% of the number of forest fires starting in the state each year are caused by settlers or some type of agricultural pursuits, a great deal better job of fire protection and forest management can be carried on with the same amount of funds.

Transferring the settlers from the poorer lands and scattered developments in the forest to the better areas

which will be adjacent to the forest projects, will not decrease their possibility of working in the forest and gaining profits from it, and on the other hand will increase their agricultural returns from being on better lands.

The accelerated settling and absorber is not only a fare deferred but increased the risk of trespass and gaps gaining of any area designed for conservation purposes.

It is important that a zoning measure, land exchange and limited acquisition be started at once, not only to correct the past mistakes as far as possible but to prevent repetition due to the back-to-the-soil movement that is rapidly taking momentum.

The present economic crisis has shown the importance of small, independent, self-sustaining units of industry, either farmers or others using the soil, tow mills, small wood working industries, and small water power plants. Such the forest units proposed are a going proposition they will furnish fuel wood, timber and all kinds of wood for market, game and recreation, and water for power purposes and human consumption, either of good or depreciation times, or rain or drouth.

All efforts and measures to encourage reforestation, and forest protection by private ownership of forest lands in this state have failed. It is learning more and more a public project.

The consolidation of the proposed areas and the beginning of intensive management can never be started at a more opportune time than the present. The land is sufficiently abandoned and it needs time planting and other forest management. Any labor put on the forest at this time for such purposes or improved and increased fire protection will eventually pay returns for the investment. The forest will not only be improved but a very large amount of relief labor can be employed.

It is to the [illegible] [illegible] a well [illegible] project. The [illegible] from an English paper in 1936 [illegible] it applies to [illegible] and a [illegible] [illegible] is very applicable to our [illegible] conditions and [illegible].

"It will perhaps be urged, that during a period of profound peace, there is little [illegible] for planting or

even for taking care of those plantations which are already on the ground, from the great depreciation in the value of timber, arising from the very extensive importation of that article from America; and the supply from the quarter being inexhaustible, the price will continue low, and hold out no inducement to the planter in this country. An American war has been, and may be still anticipated; and a long state of peace is a circumstance to which we have no right to look forward.

"In the event of an American war, the supplies from that quarter will be in a great measure cut off; and, as timber does not resemble any other crop, sown in spring, and reaped in full maturity in autumn, a time of peace is fully as proper at a season for planting as a time of war; and the present holds out many advantages for planting, for work is scarce, and labour is done at a cheap rate."

From the Forester's Guide by Robert Monteath, London, 1836.

There is a very great tendency toward overproduction in agricultural products. When farm crops are grown in a greater amount than the market can absorb, dumping prices result. To a certain extent this will be found true in forest products, but with the tendency being toward more and more public ownership of forestlands and forest products, generally non-perishable, this is not apt to be true with our future forests and the supply of material and labor necessary will continue uniform.

Certain remedial legislation necessarily must be enacted to bring about the results desirable. Land on which taxes are no longer being paid and which are not occupied should revert to the state in absolute title within these areas for reforestation and conservation purposes as directly and rapidly as possible. This can perhaps be most simply brought about through the Laws of 1927, Chapter 119, with the proper amendments and provisions. As fast as the state acquires title to lands in these areas thru acquisition, either by tax delinquency, gift or purchase, exchanges should be made so as to acquire title to lands belonging to scattered settlers and exchange them for lands in settlements where schools and roads are more readily available and soil of greater productivity.

As these areas are depopulated and local government dissolved there is going to remain a debt obligation in the

form of local bonds or outstanding warrants amounting to approximately 13 cents per acre over the entire nine projects. The local government in most of these regions is rapidly failing and sooner or later either the individuals holding bonds and warrants will take the loss or the public as a whole will have to assume their prorata share. (We found one township where they reported they could not raise enough money to print ballots to vote on dissolution).

As fast as these lands are taken over by the state for conservation purposes it should assume its prorata share in proportion to the valuation taken over. If the debt is assumed by regions or zones and they are put under a definite form of forest management at once, all investments can be expected to be repaid in some return or another at a later date. If it is taken up simply as a debt absorbing proposition without plans for management for the area and no further investment it may be considered as a total loss for the county or state assuming it.

Altho part of the areas may be taken over in their entirety there will exist areas which will always continue to have fair settlements in the forest to which will necessitate revenues for operating their local schools, government and road maintenance. As a just assistance in this need the state should expect to pay a reasonable share. This can perhaps be most equitable if done in the form of a gross receipts tax, perhaps 35% or not to exceed 50% of the entire receipts of the forest from timber, right-of-way leases, mineral and gravel leases, water storage, hunting camps, summer homes, and fishing and hunting privileges. Altho the receipts will be immediate in a very limited amount, on account of the denuded condition of most of these tracts, no appreciable receipts may be expected for another twenty years. To assist the necessary local government it will no doubt be obligatory that the state advance them a certain amount per acre, based on these anticipated receipts. This will probably be between 5 and 10 cents per acre per year. Within these acres there are considerable state school and swamp lands from which gross receipts cannot be taken. Should the principle of reimbursement on these lands prevail it would necessarily be on an acreage basis and should be only on productive land and not on lands severely burned over or of no value. This acreage payment could well be on a basis of the producing condition of the forest.

Within the tracts examined there are 80,452.52 acres of Federal lands of various classifications. These should be acquired from the Federal government thru land grant or acquisition or whatever the necessary procedure may be. It is not practical to have additional homesteaders locate in these areas. Neither is it advisable to have restricted Indian lands within areas designed for public shooting grounds or more especially game refuges.

Of the total, when standing timber was found 201,430 acres of poor stocking, 241,734 acres of medium stocking and 8,987 acres of good merchantable growth. As the area is an estimate of 888,400,000 cubic feet of merchantable timber, the cover is quite satisfactory for game production but could be improved somewhat for timber production and watershed protection.

Much can be done in the way of tree planting, improvement cutting and thinning, lake and stream development, and fire break and trail building.

The largest proportion of any such expenditures would be for labor which can be partially be performed along with unemployment relief measures. It is all beautiful and painful labor on a thorely self liquidating project, which needs the development at this time as badly as the unemployed citizens of the state need the job.

In order to properly and rapidly restore our cutaway out-over lands, for the benefit of all conservation uses, a considerable amount of tree planting is necessary at once. Since there is no large percentage of the state owned lands in need of planting and since most of the demand land is in privately owned tax delinquent tracts perfection of title in the name of the state should be accomplished immediately, so that the re-establishment of our forests may be started.

Of the seventeen measures or parts of measures proposed by the legislature this session thru sponsorship of the Division of Forestry, sixteen of them apply quite directly to the making possible of the "state conservation speed bands" outlined or for assisting in carrying out the principles and management plans involved.

Eleven of these proposed bills require no financing or appropriation on the part of the state.

Five of them will require appropriations or some definite authorization and type of financing.

The following brief statement of each of the eleven proposed measures explains their intent or purpose. In some instances they are not material while in others they are amendments to existing statutes.

1. Requires persons in the act of transporting timber products to carry with his written permission of the owner from whom he obtained the products or some other identification or proof of legal ownership. - (Amendment)

2. Make a motor vehicle used in the transportation of timber illegally out of tax delinquent land seizable for costs of prosecution. - (Amendment)

3. Make a motor vehicle used in the transportation of timber illegally cut from state and swamp lands seizable for costs of prosecution. - (Amendment)

4. Making the willful setting on fire of any forest or standing timber third degree arson. - (Amendment)

5. Requiring all Christmas trees cut and transported in larger quantities than five trees to carry a tag issued by the state for which a charge of one cent is to be made. This act it is hoped will not only reduce trespassers but will bring in some revenue for its inforcement. - (New)

6. Provide for clearing of title to state lands in "state conservation zones" where such lands were once sold and reverted to the state for non-payment of interest, taxes or payments. - (Amendment)

7. Provide that tax delinquent lands reverting to the state for non-payment of taxes as provided in Laws of 1927, Chapter 119, come to the state in absolute title without any trust features in "state conservation Zones". - (Amendment)

8. Permit the state to accept by deed or any satisfactory instrument as a gift lands within "state conservation zones" or state parks regardless of liens for taxes. - (New)

9. Provide that conservation department may acquire small areas at a low cost from department funds for firebreak purposes around state forests and state parks. - (Amendment)

10. Permit the Department of Conservation to construct temporary or permanent dams in streams or ditches for fire protection purposes. - (New)

11. Withdraw all state school and swamp lands from sale within boundaries of state conservation zones and establish them as state forests. - (New)

12. Provide that lands the state may acquire thru tax delinquency may be exchanged with private owners for lands within "state conservation zones" so as to bring about reduced local governmental expense and increased efficiency in management. - (New)

13. Pay counties 5¢ or 10¢ per acre to assist in local government on state school and swamp lands withdrawn from sale within "state conservation zones". - (New)

14. Provide that not less than 35% of the gross receipts of all kinds from lands of whatever nature acquired for conservation purposes be paid annually to the counties. - (New)

15. State to assume its prorata share of local indebtedness incurred prior to 1929 in all "state conservation zones".(New)

16. Acquire thru grant or purchase all government and Indian lands and lands subject to entry. - (New)

3. Make a motor vehicle used in the transportation of timber illegally cut from state and swamp lands satisfied for costs of prosecution. - (Amendment)

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13. Pay counties 6¢ or 10¢ per acre to assist in local government on state school and swamp lands withdrawn from sale within "state conservation zones". - (Yes)

14. Provide that not less than 25% of the gross receipts of all kinds from lands of whatever nature acquired for conservation purposes be paid annually to the counties. - (Yes)

15. State to assume its prorata share of local indebtedness incurred prior to 1929 in all "state conservation zones". (Yes)

16. Acquire thru grant or purchase all government and Indian lands and lands subject to entry. - (Yes)

FOREST PROJECTS

The following are the nine proposed state forest projects, briefly showing pertinent economic data.

BELTRAMI ISLAND STATE FOREST PROJECT

Location:	Ten miles south of Warroad in Lake-of-the-Woods and Roseau Counties.		
Area:	Gross Area		364,496 Acres
Ownership:	Federal & State	41,680 A. 11%	
	Private	322,816 A. 89%	
Taxation:	Taxable Area		322,816 Acres
	Tax Paying	78,991 A. 25%	
	Tax Delinquent	243,825 A. 75%	
	Assessed Valuation	$2.37 per acre	
	Indebtedness	.04 " "	
Population:	One to each 244 acres. Average income per worker $355.87.		
Desirability:	Good timber growing possibilities. Natural Game area for upland birds, deer and moose.		

CLOQUET VALLEY PROJECT

Location:	Twenty miles northeast of Duluth in St. Louis County.		
Area:	Gross Area		225,707 Acres
	Water Area	7,569 A. 4%	
	Land Area	218,138 A. 96%	
Ownership:	State	11,399 A. 8%	
	Private	206,739 A. 92%	
Taxation:	Taxable Area		206,739 Acres
	Tax Paid	30,230 A. 15%	
	Tax Delinquent	176,509 A. 85%	
	Assessed Valuation	$2.56 per acre	
	Tax Assessed (1930)	.34 " "	
	Tax Collected (1930)	.12 " "	
	Indebtedness	.09 " "	
Population:	One to every 336 acres. Average income per worker - $436.50.		
Desirability:	Recreational opportunities for Duluth and IronRange. Production of timber and fuelwood. Stabilization of timber markets and employment.		

PROJECT SUBJECTS

The following are the nine proposed State forest projects, briefly showing pertinent economic data.

BELLEVUE INLAND STATE FOREST PROJECT

Location:	Two miles south of Harrison in Lake-of-the-Woods and Roseau Counties.		
Area:	Gross Area		[illegible] Acres
Ownership:	Federal & State	[illegible] A. [illegible]	
	Private	[illegible] A. [illegible]	
Taxation:	Taxable Area		[illegible] Acres
	Tax Paying	[illegible] A. [illegible]	
	Tax Delinquent	[illegible] A. [illegible]	
	Assessed Valuation	[illegible] per acre	
	Indebtedness	[illegible] " "	
Population:	One to each [illegible] acres. Average income per worker [illegible].		
Desirability:	Good timber growing possibilities. Natural Game area for upland birds, [illegible] and [illegible].		

GREENBY VALLEY PROJECT

Location:	Twenty miles northeast of Toledo in St. Louis County.		
Area:	Gross Area		[illegible] Acres
	Water Area	[illegible] A. [illegible]	
	Land Area	[illegible] A. [illegible]	
Ownership:	State	[illegible] A. [illegible]	
	Private	[illegible] A. [illegible]	
Taxation:	Taxable Area		[illegible] Acres
	Tax Paid	[illegible] A. [illegible]	
	Tax Delinquent	[illegible] A. [illegible]	
	Assessed Valuation	[illegible] per acre	
	Tax Assessed (1930)	[illegible] " "	
	Tax Delinquent (1930)	[illegible] " "	
	Indebtedness	[illegible] " "	
Population:	One to every [illegible] acres. Average income per worker - [illegible].		
Desirability:	Recreational opportunities for Tulsa and Frankenburg. Production of timber and fuelwood. Stabilization of timber wastes and employment.		

FINLAND STATE FOREST PROJECT

Location:	Eighteen miles north of Beaver Bay in Lake County.			
Area:	Gross area			49,681 Acres
	Water Area	1,033 A.	2%	
	Land Area	48,648 A.	98%	
Ownership:	State	10,288 A.	21%	
	Private	38,360 A.	79%	
Taxation:	Taxable Area			38,360 Acres
	Tax Paid	19,159 A.	50%	
	Tax Delinquent	19,201 A.	50%	
	Assessed Valuation	$2.76 per acre		
	Indebtedness	.12 " "		
Population:	One to each 547 acres. Average income per worker $466.89.			
Desirability:	About 90 acres of cultivated lands and land seemingly unfit for agriculture. Good recreational opportunity for summer homesites and fine trout fishing. Good forest growth. Accessible to Duluth.			

GRAND PORTAGE STATE FOREST PROJECT

Location:	Northeastern part of state in Cook County.			
Area:	Gross Area			153,518 Acres
Ownership:	State and Government	54,201 A.	35%	
	Private	99,317 A.	65%	
Taxation:	Taxable Area			99,317 Acres
	Tax Paid	49,658 A.	50%	
	Tax Delinquent	49,659 A.	50%	
	Assessed Valuation	$2.29 per acre		
	Indebtedness	.11 " "		
Population (1930)	One to each 331 acres.			
Desirability:	Historical value. Recreational use and fair timber growth.			

[illegible]

Location:	Eighteen miles north of Beaver Bay in Lake County.		
Area:	Gross Area		[illegible] Acres
	Water Area	[illegible] A. [illegible]	
	Land Area	[illegible] A. [illegible]	
Ownership:	State	[illegible] A. [illegible]	
	Private	[illegible] A. [illegible]	
Taxation:	Taxable Area		[illegible] Acres
	Tax Paid	[illegible] A. [illegible]	
	Tax Delinquent	[illegible] A. [illegible]	
	Assessed Valuation	[illegible] per acre	
	Indebtedness	[illegible] " "	
Population:	One to each [illegible] acres. Average income per worker [illegible].		
Desirability:	About [illegible] acres of cultivated lands and land seemingly unfit for agriculture. Good recreational opportunity for summer homesites and [illegible] fishing. Good forest growth. Accessible to [illegible].		

[illegible]

Location:	Northeastern part of state of [illegible] County.		
Area:	Gross Area		[illegible] Acres
Ownership:	State and Government	[illegible] A. [illegible]	
	Private	[illegible] A. [illegible]	
Taxation:	Taxable Area		[illegible] Acres
	Tax Paid	[illegible] A. [illegible]	
	Tax Delinquent	[illegible] A. [illegible]	
	Assessed Valuation	[illegible] per acre	
	Indebtedness	[illegible] " "	
Population (1930):	One to each [illegible] acres.		
Desirability:	Historical value. Recreational are [illegible] [illegible] growth.		

GEORGE WASHINGTON STATE FOREST PROJECT

Location:	Twenty miles north of Hibbing and Iron Range in St. Louis and Itasca County.			
Area:	Gross Area			360,000 Acres
	Water Area	19,800 A.	5%	
	Land Area	340,200 A.	95%	
Ownership:	State	72,000 A.	21%	
	Private	268,200 A.	79%	
Taxation:	Taxable Area			268,200 Acres
	Tax Paid	128,736 A.	48%	
	Tax Delinquent	139,464 A.	52%	
	Assessed Valuation	$2.97 per acre		
	Indebtedness	.06 " "		
	Total delinquent tax	1.00 " "		
Population:	One to each 334 acres Average income per worker $714.52			
Desirability:	Recreational opportunity for Range towns. Many lakes, and adjoins Scenic State Park. Good game area, and is accessible source of timber and fuelwood for the Iron Range.			

KABETOGAMA STATE FOREST PROJECT

Location:	Northwest corner of St. Louis County.			
Area:	Gross Area			821,599 Acres
	Water Area	108,110 A.	14%	
	Land Area	713,489 A.	86%	
Ownership:	State Government and Indian	137,916 A.	29%	
	Private	575,573 A.	71%	
Taxation:	Taxable Area			575,573 Acres
	Tax Paid	215,573 A.	37%	
	Tax delinquent	360,000 A.	63%	
	Assessed Valuation	$2.79 per acre		
	Indebtedness	.28 " "		
Population:	One to each 351 acres. Average income per worker $434.55			
Desirability:	Finest wilderness area in midwestern states. Good game and recreational opportunities. Many summer homesites on beautiful lakes. Timber future good.			

GEORGE WASHINGTON STATE FOREST PROJECT

Location:	Twenty miles north of Nichols and from Bonne to St. Louis and Itasca County.		
Area:	Gross Area		350,000 Acres
	Water Area	18,800 A. 5%	
	Land Area	340,200 A. 95%	
Ownership:	State	72,000 A. 21%	
	Private	288,200 A. 79%	
Taxation:	Taxable Area		288,200 Acres
	Tax Paid	128,738 A. 44%	
	Tax Delinquent	159,484 A. 55%	
	Assessed Valuation	$2.97 per acre	
	Indebtedness	.08 " "	
	Total delinquent tax	1.00 " "	
Population:	One to each 336 acres Average income per worker $714.52		
Desirability:	Recreational opportunity for Range towns, many lakes, and adjoins Scenic State Park. Good game area, and is accessible source of timber and fuelwood for the Iron Range.		

KABETOGAMA STATE FOREST PROJECT

Location:	Northwest corner of St. Louis County.		
Area:	Gross Area		921,838 Acres
	Water Area	108,110 A. 14%	
	Land Area	713,488 A. 86%	
Ownership:	State Government and Indian	137,316 A. 20%	
	Private	575,573 A. 71%	
Taxation:	Taxable Area		575,573 Acres
	Tax Paid	316,375 A. 37%	
	Tax delinquent	350,000 A. 63%	
	Assessed Valuation	$0.73 per acre	
	Indebtedness	.08 " "	
Population:	One to each 331 acres. Average income per worker $404.83		
Desirability:	Finest wilderness area in midwestern states. Good game and recreational opportunities. Many summer cabinetes on beautiful lakes. Timber future good.		

SAVANNA STATE FOREST PROJECT

Location:	Adjoins McGregor on the north in Aitkin County.			
Area:	Gross Area			202,626 Acres
	Water Area	10,890 A.	5%	
	Land Area	191,736 A.	95%	
Ownership:	State	9,933 A.	5%	
	Private	181,803 A.	95%	
Taxation:	Taxable Area			181,803 Acres
	Tax Paid	49,195 A.	27%	
	Tax Delinquent	132,708 A.	73%	
	Indebtedness	$ .57 per acre		
Population:	One to each 91 acres. Average income per worker $500.60.			
Desirability:	Excellent recreational and game area, accessible to Twin Cities and Duluth. Historical value. Timber growing good.			

THIRD RIVER STATE FOREST PROJECT

Location:	Ten miles southeast of Blackduck in Itasca County.			
Area:	Gross Area			45,800 Acres
Ownership:	State and Government	10,893 A.	24%	
	Private	34,907 A.	76%	
Taxation:	Taxable Area			34,907 Acres
	Tax Paid	14,557 A.	41%	
	Tax Delinquent	20,350 A.	59%	
	Assessed Valuation	$1.54 per acre		
	Indebtedness	.15 " "		
Population:	One to each 370 acres. Average income per worker $258.85			
Desirability:	Very fine stand of merchantable timber. Good game area with possibility of recreational use.			

NAVARRA STATE FOREST PROJECT

Location:	Adjoins McGregor on the north in Aitkin County		
Area:	Gross Area		202,[illegible] Acres
	Water Area	10,880 A. 5%	
	Land Area	191,[illegible] A. 95%	
Ownership:	State	9,[illegible] A. 5%	
	Private	181,803 A. 95%	
Taxation:	Taxable Area		191,803 Acres
	Tax Paid	49,[illegible] A. [illegible]%	
	Tax Delinquent	132,708 A. 73%	
	Indebtedness	$ .57 per acre	
Population:	One to each 91 acres. Average income per worker $[illegible]		
Desirability:	Excellent recreational and game area, accessible to Twin Cities and Duluth. Historical value. Timber growing good		

THIRD RIVER STATE FOREST PROJECT

Location:	Ten miles southeast of Blackduck in Itasca County.		
Area:	Gross Area		[illegible] Acres
Ownership:	State and Government	10,[illegible] A. 24%	
	Private	[illegible],907 A. 76%	
Taxation:	Taxable Area		34,907 Acres
	Tax Paid	14,[illegible] A. [illegible]%	
	Tax Delinquent	20,350 A. 59%	
	Assessed Valuation	$1.54 per acre	
	Indebtedness	.15 " "	
Population:	One to each 373 acres. Average income per worker $[illegible]		
Desirability:	Very fine stand of merchantable timber. Good game area with possibility of recreational use		

WHITE EARTH STATE FOREST PROJECT

Location:	Immediately west of Itasca Park in Becker, Clearwater and Mahnomen Counties.			
Area:	Gross Area			289,719 Acres
	Water Area	21,055 A.	7%	
	Land Area	269,664 A.	93%	
Ownership:	State, Government and Indian	15,536 A.	6%	
	Private	253,129 A.	94%	
Taxation:	Taxable Area			253,129 Acres
	Tax Paid	86,785 A.	35%	
	Tax Delinquent	166,344 A.	65%	
	Assessed Valuation	$3.65 per acre		
	Indebtedness	.39 " "		
	Total Unpaid Tax	1.14 " "		
Population:	One to each 161 acres. Average income per worker $453.40			
Desirability:	Excellent recreational and game area accessible to people of northwestern Minnesota and prairie regions. Headwaters of rivers supplying prairie cities in Red River Valley. Source of timber and fuelwood for that section of the state.			

SAITE TANTA STATE FOREST PROJECT

Location:	Immediately west of Itasca Park in Becker, Clearwater and Hubbard Counties.		
Area:	Gross Area		229,718 Acres
	Water Area	21,068 A. 7%	
	Land Area	268,534 A. 93%	
Ownership:	State, Government and Indian	15,538 A. 6%	
	Private	253,129 A. 94%	
Taxation:	Taxable Area		262,129 Acres
	Tax Paid	65,785 A. 25%	
	Tax Delinquent	173,344 A. 65%	
	Assessed Valuation	$2.00 per acre	
	Indebtedness	.30 " "	
	Total Unpaid Tax	1.19 " "	
Population:	One to each 131 acres. Average income per worker $452.40		
Desirability:	Excellent recreational and game area accessible to people of northwestern Minnesota and prairie regions. Headwaters of rivers supplying Dakota cities in Red River Valley. Source of timber and fuelwood for that section of the state.		

GENERAL RECOMMENDATIONS

It is most urgently suggested and advised that the following plans be put into effect and operation at the earliest time possible.

1. That the nine projects completed and outlined in this report be established and set apart as "state conservation zones".

2. That these proposed projects be designated as "state conservation zones" for legislative purposes and the general region but for management and public purposes the state owned lands therein be called state forests with a definite name for each, as "White Earth State Forest". These lands set apart or acquired should be proclaimed by law to be managed for the greatest production of timber possible wherever not inconsistent with other uses capable or returning a substantial cash revenue.

3. That all the laws or measures suggested in this report that pertain to the establishment and success of these state conservation zones be provided for at once.

4. That not less than 50% and better than 75% of all the area in these "state conservation zones" come into state ownership or control as soon as possible for state forest and conservation purposes so as to bring about most economical management.

5. That since these "state conservation zones" will be protected and managed in the best manner possible, and since they have been selected in regions generally very highly valuable for game production, public shooting and recreational grounds, funds of the Game & Fish Department, as provided in Section 6, Chapter 332, Laws of 1929, for the acquisition of public shooting grounds, can well be used in assuming obligations necessary for completing the title in the name of the state over any areas within these projects that are deemed desirable by the Game & Fish Department for public shooting grounds and game refuges.

6. That since lands that went delinquent prior to 1929 or 1930 were permitted to do so voluntarily and under normal times because of removal of timber or other values or were permitted to go delinquent for "tax dodging" purposes no change in Laws 1927, Chapter 119, or concessions should be granted in connection with the payment of such taxes except conditions providing in some manner for immediate payment of taxes due. The property should no longer continue a "no man's land" but its status and title should be definitely settled and the lands put to some productive use. (It would appear that the average tax delinquency prior to 1920 is less than 5%, and in the period from 1920 to 1928 added another 40% to 50%, and since 1928 it has risen to a total average of 65%). Lands that became tax delinquent after 1929 in many instances became so on account of the inability of the owner to pay his taxes because of reduced income or other financial conditions. The owners of such property should be given every opportunity to redeem these lands.

7. That these projects be put under way immediately and that unemployment relief work projects be established in them, planting trees, improvement cutting, improving lakes and streams, building dams, providing for recreational facilities, constructing fire trails and removing fire hazards.

CENTRAL RECOMMENDATIONS

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7. That these projects be put under way immediately and that unemployment relief work projects be established in them, planting trees, improvement cutting, improving lakes and streams, building dams, providing for recreational facilities, constructing fire trails and removing fire hazards.

THE BELTRAMI ISLAND STATE FOREST

The Beltrami Island State Forest is made up of adjoining townships in western Lake of the Woods and eastern Roseau Counties. The land examined includes parts of eighteen townships with a total land area of 364,496 acres. The nearby towns are Williams, Roosevelt, Warroad and Roseau on Trunk Highway No. 11.

The area takes its name from what is geologically known as the Beltrami Island of the glacial Lake Agassiz. The topography of the area is flat with many irregular elevated areas or islands raised only a few feet above the level of the surrounding swamp lands. These islands or ridges run from east to west through the entire area and are interspersed with large and small areas of swamp land.

Land ownership within the area is largely private. A considerable share of the land is owned by absentee owners, banks, and realty companies as well as individuals. There are 38,760 acres of Federal lands in the area.

Total area	364,496	acres
Non-taxable area	41,680	"
Taxable area	322,816	"
Tax paying area	78,991	"
Tax delinquent area	243,825	"
Percentage tax delinquent		75.5%

	Acres	Percent
Tax delinquent prior to 1920	25,060	7.7
" " 1920-1928	149,025	46.1
" " 1928-1931	69,840	21.6

The rate of tax delinquency is very high in certain of the townships, the delinquency in 161-35 being 92.2%. The unpaid taxes for the area including 1930 taxes total $560,857.00, amounting to $61,626.17 in the township of Noyes (160-35) alone.

There has been constructed within this area 195¼ miles of drainage ditches. These ditches have not accomplished the results expected of them. The cost of their construction has proven too great a burden for the land to carry and consequently the land has become delinquent and the state has helped the counties to pay the ditch indebtedness. (Laws 1929, Chap.258 and Laws 1931, Chap.407) In addition to the heavy ditch indebtedness which the

THE BELTRAMI ISLAND STATE FOREST

The Beltrami Island State Forest is made up of adjoining townships in western Lake of the Woods and eastern Roseau Counties. The land examined includes parts of eighteen townships with a total land area of 324,480 acres. The nearby towns are Williams, Roosevelt, Warroad and Roseau on Trunk Highway No. 11.

The area takes its name from what is geologically known as the Beltrami Island of the glacial lake Agassiz. The topography of the area is flat with many irregular elevated areas or islands raised only a few feet above the level of the surrounding swamp lands. These islands or ridges run from east to west through the entire area and are interspersed with large and small areas of swamp land.

Land ownership within the area is largely private. A considerable share of the land is owned by absentee owners, banks, and realty companies as well as individuals. There are 38,760 acres of Federal lands in the area.

Total area	324,480 acres
Non-taxable area	41,880 "
Taxable area	322,916 "
Tax paying area	70,[illegible] "
Tax delinquent area	243,[illegible] "
Percentage tax delinquent	76.5%

		Acres	Percent
Tax delinquent prior to			
	1920	25,080	7.7
" "	1920-1930	149,033	46.1
" "	1930-1940	69,340	21.4

The rate of tax delinquency is very high in certain of the townships, the delinquency in 1921-22 being 53.3%. The unpaid taxes for the area including 1920 taxes total $360,[illegible].00, amounting to $[illegible].17 in the township of Boyes (160-33) alone.

There has been constructed within this area 1[illegible] miles of drainage ditches. These ditches have not accomplished the results expected of them. The cost of their construction has proven too great a burden for the land to carry and consequently the land has become delinquent and the state has helped the counties to pay the ditch indebtedness. (Laws 1923, Chap. 253 and Laws 1925, Chap. 407) In addition to the heavy ditch indebtedness which the

state has assumed, there still exists a bonded indebtedness of $13,593.23 for schools, roads, etc. The unextended balances on the ditch liens for the area amount to $39,015.56.

Of the area surveyed, 95,800 acres are classed as non-timbered, the remaining 268,695 acres support stands of timber which are largely young growth. However, there has been estimated to be 34,297,300 cu. ft. of merchantable timber now on the area. The young stands are making excellent growth, and much will shortly become of merchantable size. Timber production on the area should prove quite profitable. The area is so located that it may easily supply the local farming communities, as well as the farming communities of the adjacent Red River Valley, with the timber products which they need.

The soils of the area may be divided into two classes: the swamp or peat soils, and the upland soils. The peat soils, most of which are of the shallow phase, cover a considerable share of the area. The upland soils consist mainly of sands and loamy sands with some areas of heavier sandy loams.

Agricultural development is limited largely to these areas of heavier soils. Little or no farming is done on the peat soils and the attempts to farm the light soils are largely unsuccessful. Most of the better farms are located in the extreme western portion of the area and along the northern boundary.

The average income from all occupations for all heads of families living in the forest is $355.87, divided as follows:

Income from U.S., State and County	$80.90
" " farming	118.07
" " timber operations	56.10
" " occupations dependent upon the forest, such as trapping, berry picking, etc.	25.00
Income from stores and miscellaneous	75.80

It is proposed to eliminate 2-2/3 townships from the western and northern portions of the area as shown on the field map, thereby removing a large proportion of the better farming land from the forest area. This area has a low percentage of delinquency and its elimination from the area will raise the rate for the remaining portion. The removal of this area will also greatly reduce the

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Of the area surveyed, 95,800 acres are classed as non-timbered, the remaining 288,496 acres support stands of timber which are largely young growth. However, there has been estimated to be 34,297,300 cu. ft. of merchantable timber now on the area. The young stands are making excellent growth, and much will shortly become of merchantable size. Timber production on the area should prove quite profitable. The area is so located that it may easily supply the local farming communities, as well as the farming communities of the adjacent Red River Valley, with the timber products which they need.

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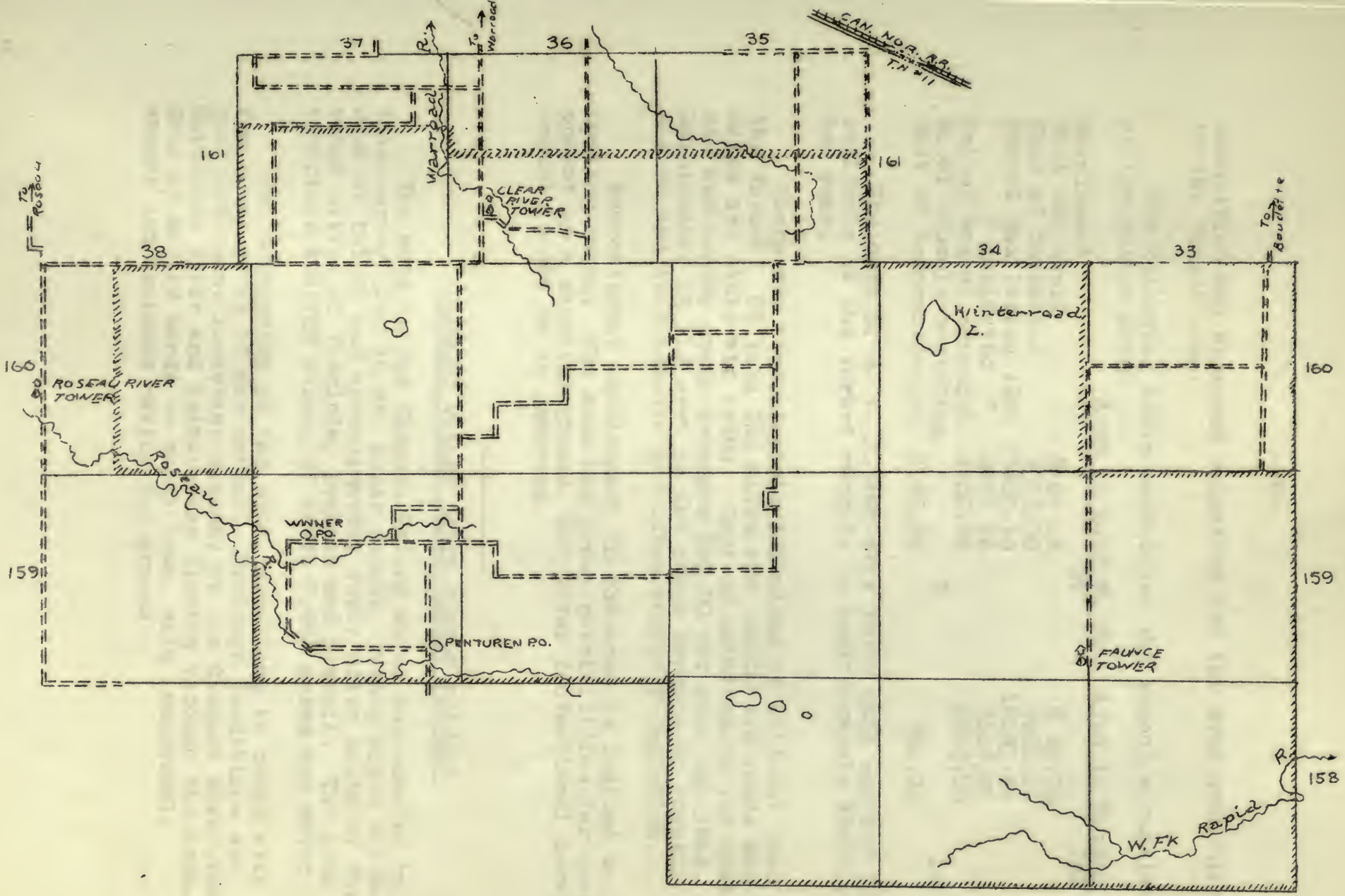
Agricultural development is limited largely to these areas of heavier soils. Little or no farming is done on the peat soils and the attempts to farm the light soils are largely unsuccessful. Most of the better farms are located in the extreme western portion of the area and along the northern boundary.

The average income from all occupations for all heads of families living in the forest is $355.87, divided as follows:

Income from U.S., State and County	$90.90
" " farming	118.07
" " timber operations	68.10
" " occupations dependent upon the forest, such as trapping, berry picking, etc.	35.00
Income from stores and miscellaneous	73.80

It is proposed to eliminate 2-4/5 townships from the western and northern portions of the area as shown on the field map, thereby removing a large proportion of the better farming land from the forest area. This area has a low percentage of delinquency and its elimination from the area will raise the rate for the remaining portion. The removal of this area will also greatly reduce the



PROPOSED
BELTRAMI ISLAND
STATE FOREST

population and assessed valuation for the area remaining in the forest area.

The following table summarizes the school situation of the entire area:

	Area in L.of W. Co.	Area in Roseau Co.
Enrollment	97	282
Cost per pupil	$ 54.13	$ 50.00
Cost of Operation	3059.00	9600.00
School tax levied 1930	13280.10	16181.66
" " collected "	4707.33	3115.82
Val.of school property	8500.00	6500.00
No.of schools operating	6	16
Cost of transportation	2193.68	700.00

The cost of R. F. D. and star route mail service for residents of the forest amounts to approximately $6840.00 per year.

There are approximately 301 miles of laid out road in the forest. Of this 35½ miles are county aid roads and 19 miles are state aid roads. Cost of maintenance for state aid and county roads averages $50.00 per mile per year. Maintenance on the rest of the roads depends on township action and is spasmodic and often entirely neglected.

Recreational development in the area is limited to hunting camps. The area has great possibilities for development as a shooting ground, but other recreational development is not to be expected.

CLOQUET VALLEY STATE FOREST PROJECT

The area in the Cloquet Valley which was covered by this survey lies in St. Louis County, twenty miles northwest of Duluth and approximately forty miles south of the range cities of Virginia, Eveleth and Biwabik. The area comprises 225,706 acres, of which 7,569 acres are water.

The topography of the area is rolling to rough with few level areas of any extent. Drainage conditions are good with many important streams as the Cloquet River, the Whiteface River and tributaries flowing through the area. Soil is mostly sandy to sandy loam, with innumerable stones and boulders paving the ground.

population and assessed valuation for the area remaining in the forest area.

The following table summarizes the school situation of the entire area:

	Area in L. of W. Co.	Area in Roseau Co.
Enrollment	27	252
Cost per pupil	$ 54.13	$ 50.00
Cost of Operation	3059.00	9600.00
School tax levied 1930	13280.10	16181.68
" " collected "	4707.33	3115.82
Val. of school property	8500.00	6500.00
No. of schools operating	6	16
Cost of transportation	2193.88	700.00

The cost of R. F. D. and star route mail service for residents of the forest amounts to approximately $6640.00 per year.

There are approximately 30½ miles of laid out road in the forest. Of this 35½ miles are county aid roads and 19 miles are state aid roads. Cost of maintenance for state aid and county roads averages $60.00 per mile per year. Maintenance on the rest of the roads depends on township action and is spasmodic and often entirely neglected.

Recreational development in the area is limited to hunting camps. The area has great possibilities for development as a shooting ground, but other recreational development is not to be expected.

CLOQUET VALLEY STATE FOREST PROJECT

The area in the Cloquet Valley which was covered by this survey lies in St. Louis County, twenty miles northwest of Duluth and approximately forty miles south of the range cities of Virginia, Eveleth and Hibbing. The area comprises 285,708 acres, of which 7,559 acres are water.

The topography of the area is rolling to rough with few level areas of any extent. Drainage conditions are good with many important streams as the Cloquet River, the Whiteface River and tributaries flowing through the area. Soil is mostly sandy to sandy loam, with innumerable stones and boulders paving the ground.

Land ownership in the area is made up as follows:

State	5.05%
Lumber Companies	47.12%
Realty Companies	7.00%
Railroad Companies	5.07%
Other Companies	7.05%
Private (mostly general absentee owners)	26.95%
Recreational (Summer home owners)	.75%
	100. %

The tax delinquency for the area is shown by the following tax data:

Taxable area	206.739 Acres	
Tax delinquent	176,509 Acres	- 85.%
Tax paid	30,230 Acres	- 15.%
	206,739 Acres	100.%

Tax delinquent prior to 1920	1,640 Acres	1.%
" " 1920-1928	143,441 Acres	67.%
" " 1928-1931	31,428 Acres	14.%

Assessed valuation - $548,687 or $2.56 per acre

Amount Tax Assessed (1930)	73,372.72 or $.34 per acre
Amount Tax Collected (1930)	25,059.31 or $.117 per acre
Outstanding Warrants, Bonded Indebtedness and State Loans (Mar.1932)	21,230.96 or $.091 per acre

Approximately 46 percent of the area is covered with hardwood forests, consisting of aspen, birch and mixed hardwoods. Conifers (pines, balsam, spruce, cedar and tamarack) cover 63,847 acres or 31%. There are 11,801 acres of water which is 6% of the entire area.

Land Use

Forest (Conifers	52,252 A	- 23%
Forest (Hardwoods	112,032 A	- 50%
Forest (Brush, Marsh	53,359 A	- 23%
Improved	498 A	- -
Water	7,569 A	- 4%
	225,707 A	

Agriculture development has been small, with only 24 farms on the area and a total of 342 acres actually under cultivation.

Land ownership in the area is as follows:

Jiria	[illegible]
Lower Kuruwala	[illegible]
Berly Tongalung	[illegible]
Galiyow Tongalung	[illegible]
Other Owners	[illegible]
Private Leasing Pastoral Company	
(W.A.)	[illegible]
Northwestern Tobacco Area (Queensland)	[illegible]
Total	[illegible]

The tax delinquency for the area is above or the following tax years:

Jiria area	[illegible]
The Gallows	[illegible]
The Lake	[illegible]
	[illegible]

The delinquency prior to [illegible] area [illegible]
" " [illegible] [illegible]
" " [illegible] [illegible]

Average valuation - [illegible] or [illegible] per [illegible]
Amount tax arrears
(1970) [illegible] or [illegible] per [illegible]
Amount tax delinquency
(1970) [illegible] or [illegible] per [illegible]
Conservative Terrace,
Shaded Lookout,
Big Bluff Lodge
(Est.3050) [illegible] or [illegible] per [illegible]

Approximately 40 percent of the area is covered with Narrowed Tumbrie, consisting of [illegible], [illegible] and [illegible] bandwood. Cottage (pines, Eulam, Spruce, Cedar and Tamarack) cover 50,847 acres or 31%. There are 31,202 acres of water which is on or the white area.

Land Use

Dairy	[illegible]
Fruit Berries	[illegible]
Grain, Hay	[illegible]
Improved	[illegible]
Water	[illegible]
	[illegible]

Agricultural production has been [illegible], with only 24 farms in the area and a total of [illegible] acres actually under cultivation.

PROPOSED
CLOQUET VALLEY STATE FOREST

Transportation facilities are fair with both a gravel road and railroad running through the center of the tract.

Sources of Incomes	Total Incomes	Percent
Public Works	$9,866.00	38.97
Incomes dependent upon forest	7,130.00	28.16
Employment outside forest	3,150.00	12.44
Farming	2,845.00	11.23
Other	2,326.00	9.20
Totals	$25,317.00	100. %
Average Income Heads of families	436.50	

The only school in the area is located at Brimson. It has a value of $5,200, and the annual cost is $4,116. The amount collected for schools in the area in 1931 was $14,459 which is 58% of entire tax collection. There is an enrollment of twenty in the school, making the per pupil cost $206.

There are 64 miles of road with an annual maintenance cost of $15,688, or $245 per mile.

Recreational prospects are good with 16 medium or large sized lakes and some smaller ones on the area, all within one hour's ride of 100,000 people. These lakes offer an opportunity for the development of public bathing beaches and picnic grounds, as well as leased public homesites. The area supports a good game and fish population at present, but further stocking and better protection is necessary.

FINLAND STATE FOREST PROJECT

The Finland State Forest lies in the northeastern part of Minnesota, wholly within the boundaries of Lake County. It is a triangular-shaped tract of land bounded roughly on the east by State Aid Road #3, and on the west by State Aid Road #4. North line of Township 59N marks the north boundary. It embraces an area of 49,681 acres.

The following indicates the class of ownership in the proposed forest:

State	10,288 acres	21%
Private	21,556 acres	44%
Corporate	16,804 acres	35%
Total land area	48,648 acres	

Transportation facilities are fair with good a canal and the district roads serving Kenmuir are owned by the [illegible].

Sources of Income	Total Income	% Income
Public Funds	$[illegible]	[illegible]
Income derived over (cost)	$ 7,180.00	[illegible]
Self-support outside funds	$ [illegible]	[illegible]
Fundraising	$ [illegible]	[illegible]
Other	$ [illegible]	[illegible]
Totals	$[illegible]	[illegible]
Average Income		
Needs of Facilities	[illegible]	

The only school in the area is located at Kenmuir. It has a value of $[illegible] and the annual cost is $4,316. The amount collected for education in the area in 1951 was $[illegible] which is 30% of which has delinquent. There is no [illegible] of truancy in the school, making the average [illegible] over 250.

There are 44 miles of roads with an annual maintenance cost of $[illegible], or [illegible] per mile.

Recreational facilities are good with 18 acres of large sized lake and some smaller ones on the area, all within one hour's drive of 100,000 people. These lakes offer an opportunity for the development of water sports including boating and [illegible] fishing, as well as [illegible] facilities. The area supports a good game and fish population of [illegible], but further stocking and better protection is necessary.

FINLAY STATE FOREST RESERVE

The Finlay State Forest lies in the northwestern part of Kenmuir, [illegible] the Saskatchewan [illegible] County. It is a [illegible] [illegible] of land covered mostly by the [illegible] of [illegible] [illegible] [illegible]

Approximately 18,168 acres or 47 percent of the taxable area is now delinquent.

Delinquency of area by periods:

Prior to 1920	1724 acres -	4%
1920 to 1928	13110 acres -	34%
1928 to 1930 (inc.)	3334 acres -	9%

The different types of public indebtedness for which this area of land is liable is about $9,000.00.

The land cover types within the tract are as follows:

26,920	acres	or 54.19%	in	merchantable timber.
6,252	"	" 12.40%	"	reproduction timber
15,386	"	" 30.97%	"	brush
1,033	"	" 2.09%	"	water
90	"	" .18%	"	improved land

With only 90 acres of cultivated land within the area, it is evident that the agriculture possibilities are very poor. The soil is of a sandy to stoney loam type. The topography is rough and hilly, and this, combined with the short growing season and high elevation makes farming very uncertain.

The average income of wage earners in this forest is $466.89 a year. It is earned from five sources as follows:

U.S., State, County and Township	$325.48	70%
Farming	12.21	3%
Timber	1.62	-
Trapping, Resort, Berrypicking, etc.	50.54	10%
Stores and misc. employment	77.04	17%

The headwaters of the main tributaries of the Baptism and Manitou Rivers are on this forest. These are not only two of the best trout fishing streams on the North Shore but they have many beautiful rapids and falls of great value for scenic purposes, and possible power uses. The main road from Lake Superior and Highway No. 1, through the Superior National Forest to Ely passes alongside of this forest.

Approximately 18,108 acres or 47 percent of the taxable area is now delinquent.

Delinquency of area by periods:

Prior to 1920	1724 acres	- 4%
1920 to 1928	13110 acres	- 34%
1928 to 1930 (inc.)	3334 acres	- 9%

The different types of public indebtedness for which this area of land is liable is about $8,000.00.

The land cover types within the tract are as follows:

28,920	acres	or	34.19%	in merchantable timber.
6,252	"	"	12.40%	" reproduction timber
15,386	"	"	30.97%	" brush
1,023	"	"	2.09%	" water
90	"	"	.18%	" improved land

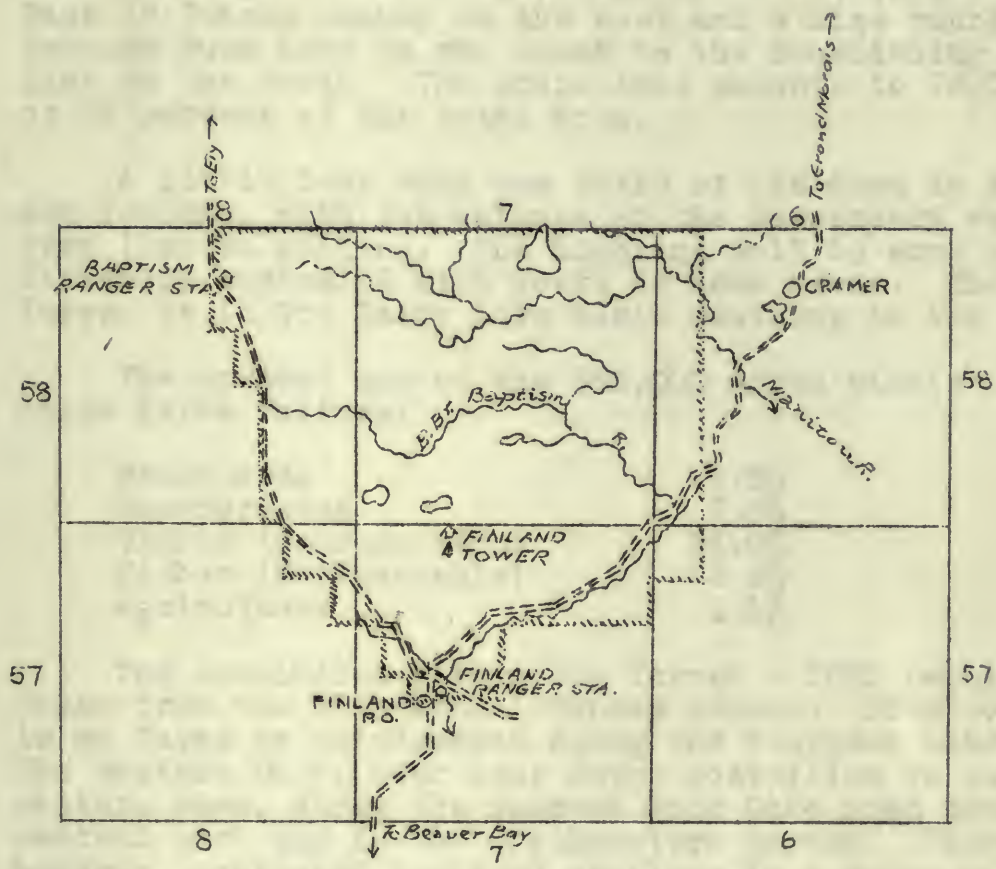
With only 90 acres of cultivated land within the area, it is evident that the agriculture possibilities are very poor. The soil is of a sandy to stoney loam type. The topography is rough and hilly, and this, combined with the short growing season and high elevation makes farming very uncertain.

The average income of wage earners in this forest is $456.89 a year. It is earned from five sources as follows:

U.S., State, County and Township	$325.46	70%
Farming	12.21	3%
Timber	1.83	-
Trapping, Resort, Berrypicking, etc.	50.34	10%
Stores and misc. employment	77.04	17%

The headwaters of the main tributaries of the Bantism and Manitou Rivers are on this forest. These are not only two of the best trout fishing streams on the North Shore but they have many beautiful rapids and falls of great value for scenic purposes, and possible power uses. The main road from Lake Superior and Highway No. 1, through the Superior National Forest to Ely passes alongside of this forest.

PROPOSED
FINLAND STATE FOREST


To Ely
To Ely
To Ely

GEORGE WASHINGTON MEMORIAL STATE FOREST

This forest, located immediately north of the Iron Range is fortunately situated to provide the benefits of timber production, recreation, and game and fish habitate to an area of approximately 2-1/2 million acres, with 75,000 population. The forest includes the territory from Side Lake in S t. Louis County on the east to Scenic Park in Itasca County on the west and a line running through Buck Lake on the south to the Koochiching County line on the north. The state land amounts to 72,000 acres, or 21 percent of the total area.

A little less than one third of the area is swamp and lowland, with the balance of the topography varying from flat to rolling. The highland soil is sand to clay liberally sprinkled with rocks in some areas. The entire forest is in the Rainy Lake basin draining to the north.

The present use of the 360,000 acres within the boundaries is as follows:

Water area	5.5%
Non-forested	7.0%
Timber (Reproduction)	64.0%
Timber (Merchantable)	22.4%
Agriculture	1.1%

The population within the forest - 1020 people - taken from the 15th-Annual Census Report. This population is on farms or settlements along the Sturgeon Lake road in the eastern part, near Bear River postoffice in the northeastern area, along the Nashwak Buck Lake road down the central part and in the northwestern corner. There are, however, scattered isolated settlers in a dozen of the 17½ townships. Of the population there are 182 school children attending eight schools, the average cost per pupil being $195.47. There are about 220 miles of road for which the annual maintenance is about $108,000.

The average income from all occupations for all individuals living in the forest is $714.52, divided as follows:

Income from U.S., State, County and Twp.	$218.64	- 31%
Income from timber operations	182.92	- 25%
Income from farming	165.05	- 23%
Income from stores, fur farming, construction work and misc. labor	78.60	- 11%
Income from occupations dependent upon the forest, such as guiding, trapping, fishing, berry picking, resorts, etc.	69.31	- 10%
	$714.52	

GEORGE WASHINGTON MEMORIAL STATE FOREST

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The present use of the 350,000 acres within the boundaries is as follows:

Water area	5.9%
Non-forested	7.0%
Timber (Reproduction)	44.0%
Timber (Merchantable)	22.4%
Agriculture	1.1%

The population within the forest - 1000 people - taken from the 15th-Annual Census Report. This population is on farms or settlements along the Sturgeon Lake road in the eastern part, near Bear River postoffice in the northeastern area, along the Washwak Buck Lake road down the central part and in the northwestern corner. There are, however, scattered isolated settlers in a dozen of the 17½ townships. Of the population there are 182 school children attending eight schools, the average cost per pupil being $195.47. There are about 220 miles of road for which the annual maintenance is about $108,000.

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Income from U.S., State, County and Two.	$219.54 - 31%
Income from timber operations	183.83 - 25%
Income from farming	155.05 - 23%
Income from stores, fur farming, construction work and misc. labor	78.60 - 11%
Income from occupations dependent upon the forest, such as guiding, trapping, fishing, berry picking, cocorts, etc.	69.31 - 10%
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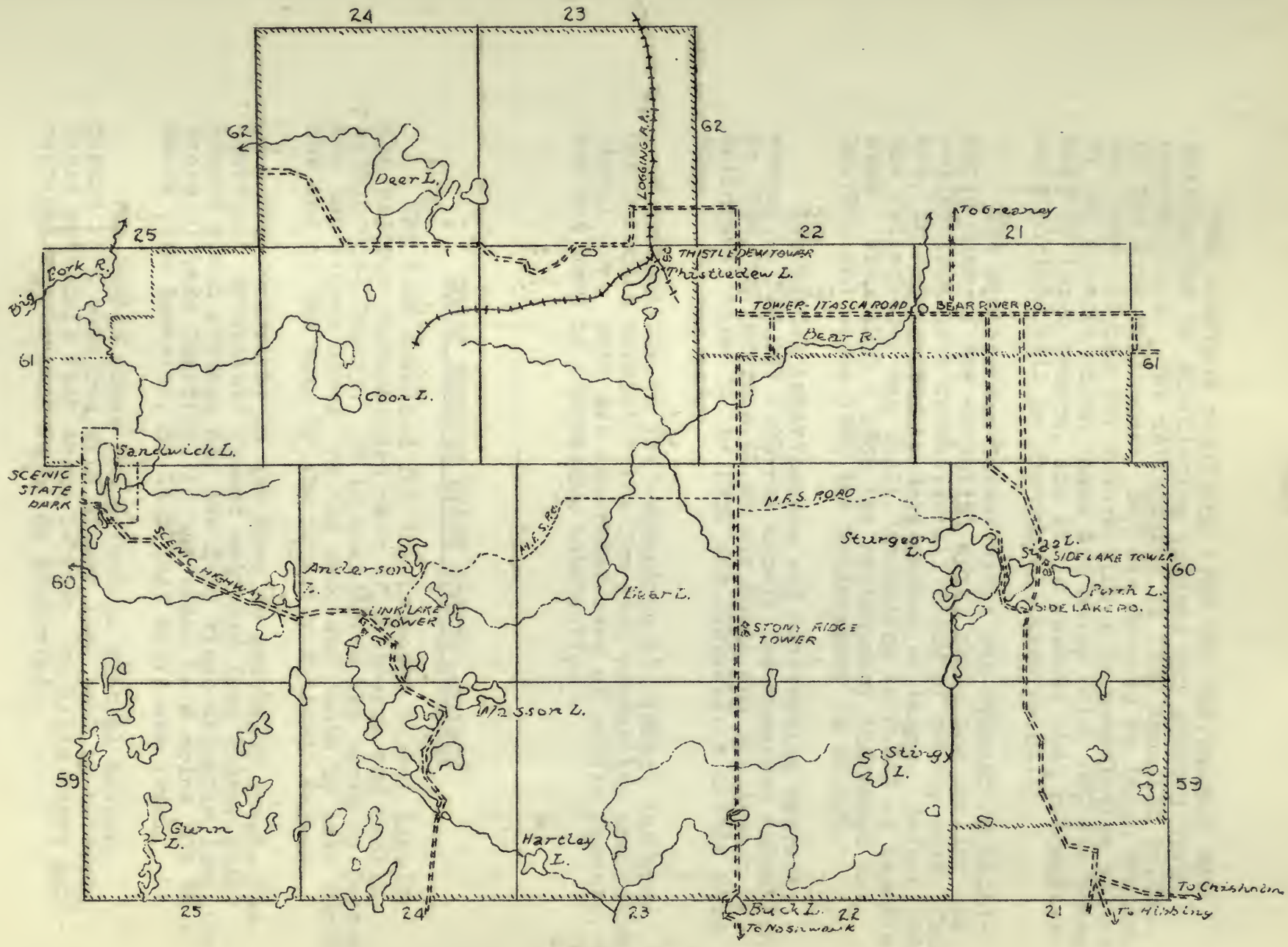
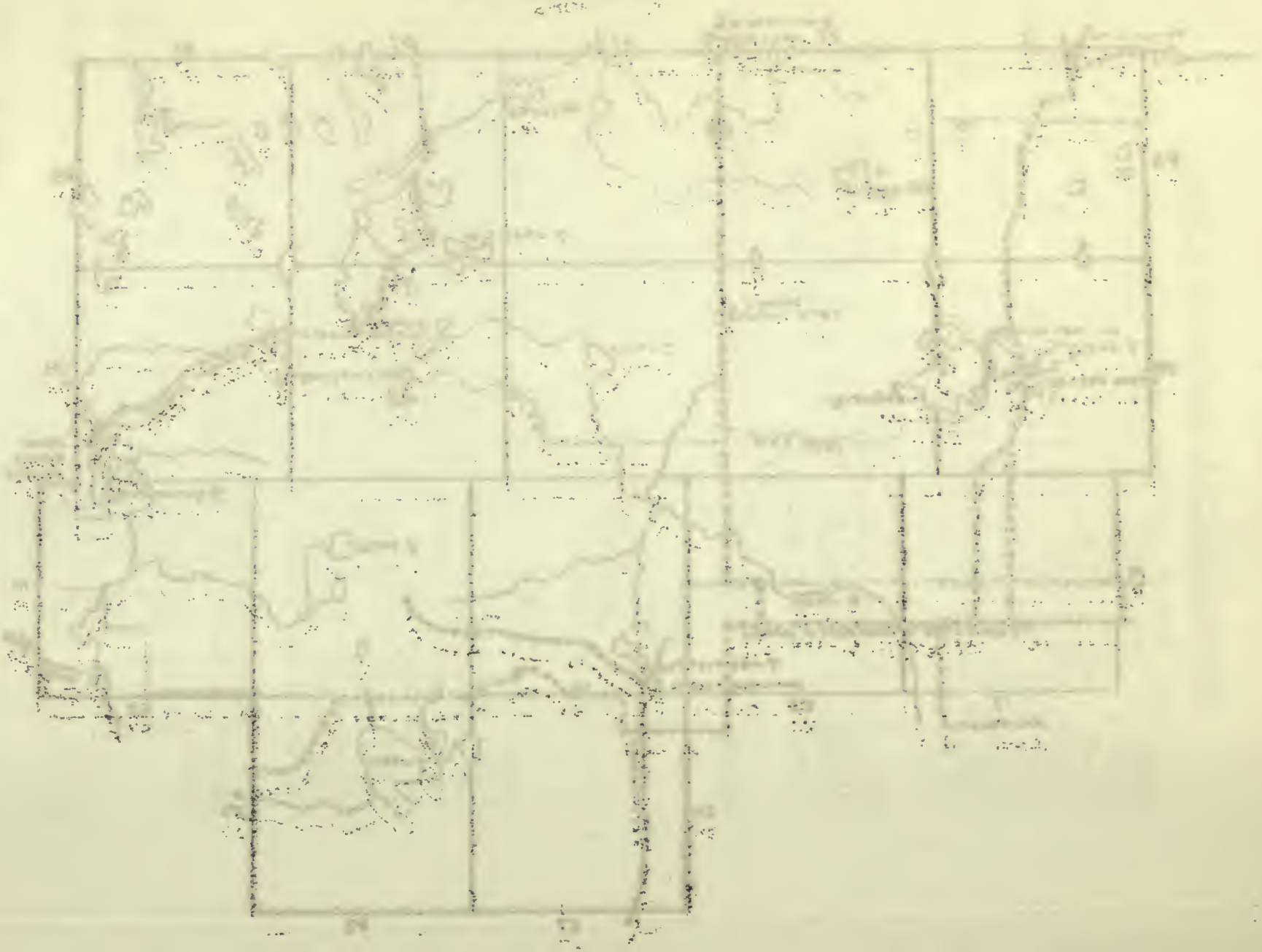


PROPOSED
GEORGE WASHINGTON MEMORIAL
STATE FOREST



The problems resulting from the delinquency are intensified by diminishing forests and reduced civic expenditures. The delinquency in 1930 amounted to 52%. Of the area delinquent, 54% was dropped by large owners, who were holding for future timber or speculative values. Of the area on which taxes are being paid, 62% are being paid by large owners, and it is assumed that a considerable portion will be dropped as taxes mount.

The diminishing forest areas has reduced or eliminated much of the potential work, while the smaller tax collections have curtailed all forms of county work. This has, in turn, added to delinquency of taxes. Before 1920 the delinquency was small, amounting to 6.44% of taxable area. From 1920 - 1928 the delinquency increased to 32.79%, and since 1928 the delinquency is 52.00%.

The bonded indebtedness and outstanding warrants amount to $18,087 (.06 per acre); the assessed valuation is $794,005 (average $2.97 per acre) and the amount of delinquent taxes up to 1930 was $139,212, a little more than $1.00 per acre.

In addition to the production of timber, the area has splendid possibilities for game production and recreational use. Both are important uses of public forests, and the need is increasing constantly.

GRAND PORTAGE STATE FOREST PROJECT

The area examined for the proposed forest lies in the extreme northeastern part of Minnesota and wholly within Cook County. It is bounded on the north by Canada and the Pigeon River, on the east and south by Lake Superior and on the west by the Superior National Forest.

The topography of the area is generally rough. The "Sawtooth Mountains" extend westward from Pigeon Point. Around Grand Portage Bay the land rises abruptly from the shore of Lake Superior, in one place to a point 703 feet above Lake Superior, or 1305 feet above sea level.

The region shows the effect of glacial action, ragged rock outcrops with stoney loam soil in between. There are small flat areas between the hills where agricultural development is being attempted.

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The topography of the area is generally rough. The "Sawtooth Mountains" extend westward from Pigeon Point. Around Grand Portage Bay the land rises abruptly from the shore of Lake Superior, in one place to a point 702 feet above Lake Superior, or 1306 feet above sea level.

The region shows the effect of glacial action, ragged rock outcrops with stoney loam soil in between. There are small flat areas between the hills where agricultural development is being attempted.

Within the area are many short streams in addition to the larger rivers, the Pigeon, South Brule and Reservation River. Pigeon River has a rocky bed and rapid flow thru canyons, over several rapids and some fine water falls. High Falls, the finest of these, is located about two miles from the mouth. The Brule crosses the southwest corner of the area.

A series of three lakes form a part of the international boundary - Moose Lake, North Fowl Lake, and South Fowl Lake, and there are several other lakes in the area.

The unit has a land area of 153,518 acres.

Ownership

Private	56,496	acres or	37%
Corporate	42,821	" "	28%
State Lands — mostly Indian	27,602	" "	18%
Federal Lands	26,599	" "	17%
	153,518	" "	100%

50% of the taxable area is delinquent.
Total delinquency is 49,774.68 acres.

Previous to 1920	9%	went del.
1920 to 1927	18%	" "
1928 to 1930	23%	" "
Total delinquency at present ...	50%	

There is a bonded indebtedness of $11,000.00.

The region was formerly completely forested with a stand of white and Norway pine, balsam and mixed hardwoods, and lowland conifers. During the past thirty years, the entire area, except state owned lands, has been logged over.

The present stand consists of 54,000 acres of merchantable timber - 36% of the area, and 93,000 acres of reproduction which is 60%. The remaining 5,000 acres, or 4 percent, are nonforested, consisting of brush highland and marsh or open bog, or rock outcrop.

The population is 464 people, with commercial fishing as the principal occupation. There are 31 farms with a total area of 4,426 acres. Twenty-nine miles of State and County roads serve the district, and excellent bus service is maintained daily between Pigeon River and Duluth.

Within the area are many short streams in addition to the larger rivers, the Pigeon, South Brule and Reservation River. Pigeon River has a rocky bed and rapid flow thru canyons, over several rapids and some fine water falls. High Falls, the finest of these, is located about two miles from the mouth. The Brule crosses the southwest corner of the area.

A series of three lakes form a part of the international boundary - Moose Lake, North Fowl Lake, and South Fowl Lake, and there are several other lakes in the area.

The unit has a land area of 153,518 acres.

Ownership

Private	56,498 acres	or 37%
Corporate	43,821 "	" 28%
State Lands	27,902 "	" 18%
Federal Lands	26,549 "	" 17%
	153,518 "	" 100%

50% of the taxable area is delinquent.
Total delinquency is 48,774.58 acres.

Previous to 1920	9%	went del.
1920 to 1927	18%	" "
1928 to 1930	23%	" "
Total delinquency at present	50%	

There is a bonded indebtedness of $11,000.00.

The region was formerly completely forested with a stand of white and Norway pine, balsam and mixed hardwoods, and lowland conifers. During the past thirty years, the entire area, except state owned lands, has been logged over.

The present stand consists of 24,000 acres of merchantable timber - 28% of the area, and 92,000 acres of reproduction which is 60%. The remaining 5,000 acres, or 4 percent, are nonforested, consisting of brush highland and marsh or open bog, or rock outcrop.

The population is 454 people, with commercial fishing as the principal occupation. There are 31 farms with a total area of 4,480 acres. Twenty-nine miles of State and County roads serve the district, and excellent bus service is maintained daily between Pigeon River and Duluth.

PROPOSED
GRAND PORTAGE STATE FOREST

This district is rich in historical lore. More than thirty years before the founding of Fort Snelling, generally considered the beginning of Minnesota history, a post was built at Grand Portage Bay, and more than a thousand white men assembled there year after year. The only military operations of the American Revolution within the state occurred here. A road nine miles long between Grand Portage and Pigeon River was constructed and is today, by virtue of a treaty, still an international highway - the only road of its kind in the United States, and still known by its early name, Grand Portage.

With the economic situation pointing to bankruptcy under the present development it is well to consider the practicability of putting this area on a sound basis of management for timber production, game and fish and recreational development whereby an increasing definite money return may be expected in the future.

KABETOGAMA FOREST

The Kabetogama State Forest as proposed for future development, is one of the most northerly of all state forest areas. The unit is located in the extreme northwest corner of St. Louis County. It is bounded roughly by State Highway No. 11 on the west, County Highway No.23 on the south and County Highway No. 24, together with Sand Point and Crane Lake on the east, and the international boundary lakes, Kabetogama, Nanekan on the north.

The area comprises about 35 townships with an acreage of 713,480 acres.

Ownership of Area

Settlers and Farmers	57,920
Summer and Hunting Resorts	1,600
Small absentee owners	321,682
Corporate other than lumber companies	3,500
Banks	9,000
Realtors	38,000
Lumber Companies	143,871
Indian Lands	1,500
State Lands	135,516
Federal Lands	900
Total	713,489 Acres

360,000 acres, or 62% of the taxable land is delinquent.

This district is rich in historical lore. More than thirty years before the founding of Fort Snelling, generally considered the beginning of Minnesota history, a post was built at Grand Portage Bay, and more than a thousand white men assembled there year after year. The only military operations of the American Revolution within the state occurred here. A road nine miles long between Grand Portage and Pigeon River was constructed and is today, by virtue of a treaty, still an international highway - the only road of its kind in the United States, and still known by its early name, Grand Portage.

With the economic situation pointing to bankruptcy under the present development it is well to consider the practicability of putting this area on a sound basis of management for timber production, game and fish and recreational development whereby an increasing definite money return may be expected in the future.

KABETOGAMA FOREST

The Kabetogama State Forest as organized for future development, is one of the most northerly of all state forest areas. The unit is located in the extreme northwest corner of St. Louis County. It is bounded roughly by State Highway No. 11 on the west, County Highway No. 23 on the south and County Highway No. 24, together with Sand Point and Crane Lake on the east, and the international boundary lakes, Kabetogama, Rainbow on the north.

The area comprises about 35 townships with an acreage of 713,480 acres.

Ownership of Area

Settlers and Farmers	57,[illegible]
Summer and Hunting Resorts	1,800
Small sawmill owners	321,[illegible]
Corporate other than lumber companies	3,[illegible]
Banks	9,000
Realtors	39,000
Lumber Companies	143,371
Indian Lands	1,800
State Lands	136,[illegible]
Federal Lands	800
Total	713,[illegible] Acres

360,000 acres, or 65% of the taxable land is delinquent.

Outstanding Warrants 1932

Portage	$1,422.97
Leiding	4,847.06
Beatty	104.59
Total	6,374.62

An idea of the trend of annual valuations is given by the following figures taken on five typical townships (Twp. 63-77-68-69-70, Range 19). These townships are unquestionably non-agricultural.

Assessed Valuation

1918	$228,977
1920	649,482
1922	636,316
1924	533,115
1926	454,243
1928	361,555
1930	262,329

showing a decline of 40.39% from the peak year as timber was removed.

The forest on the area is well stocked and making excellent growth. It is well adapted to timber production. Of the area:

148,325 acres are in merchantable timber
514,114 " " " reproduction
21,000 " " barren
30,000 " " settled.

The total population of the area is 2,035, of which only 197 are in the trading centers within the area. There are 362 occupied farms and 147 abandoned farms in the area.

The average annual income for residents of the area is $430.65, divided as follows:

Income from Twp.,County,State and U.S.Gov't	$95.95-22%
Income from farming	87.00-20%
Income from miscellaneous sources	98.45-23%
Income from timber	23.95- 6%
Income from sources dependent upon the forest	125.30-29%

In addition to the taxes levied and collected in the taxing units in the area, there is an apportionment from various other sources to the amount of $1,972.74 to that portion of the area within the organized school district No.9 (figured on a pro rata basis by area).

Outstanding Warrants 1933

Portage	1,462.87
Leiding	4,847.98
Beatty	104.52
Total	6,374.33

An idea of the trend of annual valuations is given by the following figures taken on five typical township (Tps. 83-77-88-89-70, Range 19). These townships are unquestionably non-agricultural.

Assessed Valuation

1916	232,977
1920	249,462
1922	339,316
1924	323,118
1928	464,241
1932	381,555
1933	292,329

showing a decline of 40.35% from the peak year as timber was removed.

The forest on the area is well stocked and making excellent growth. It is well suggested to timber reproduction. Of the area:

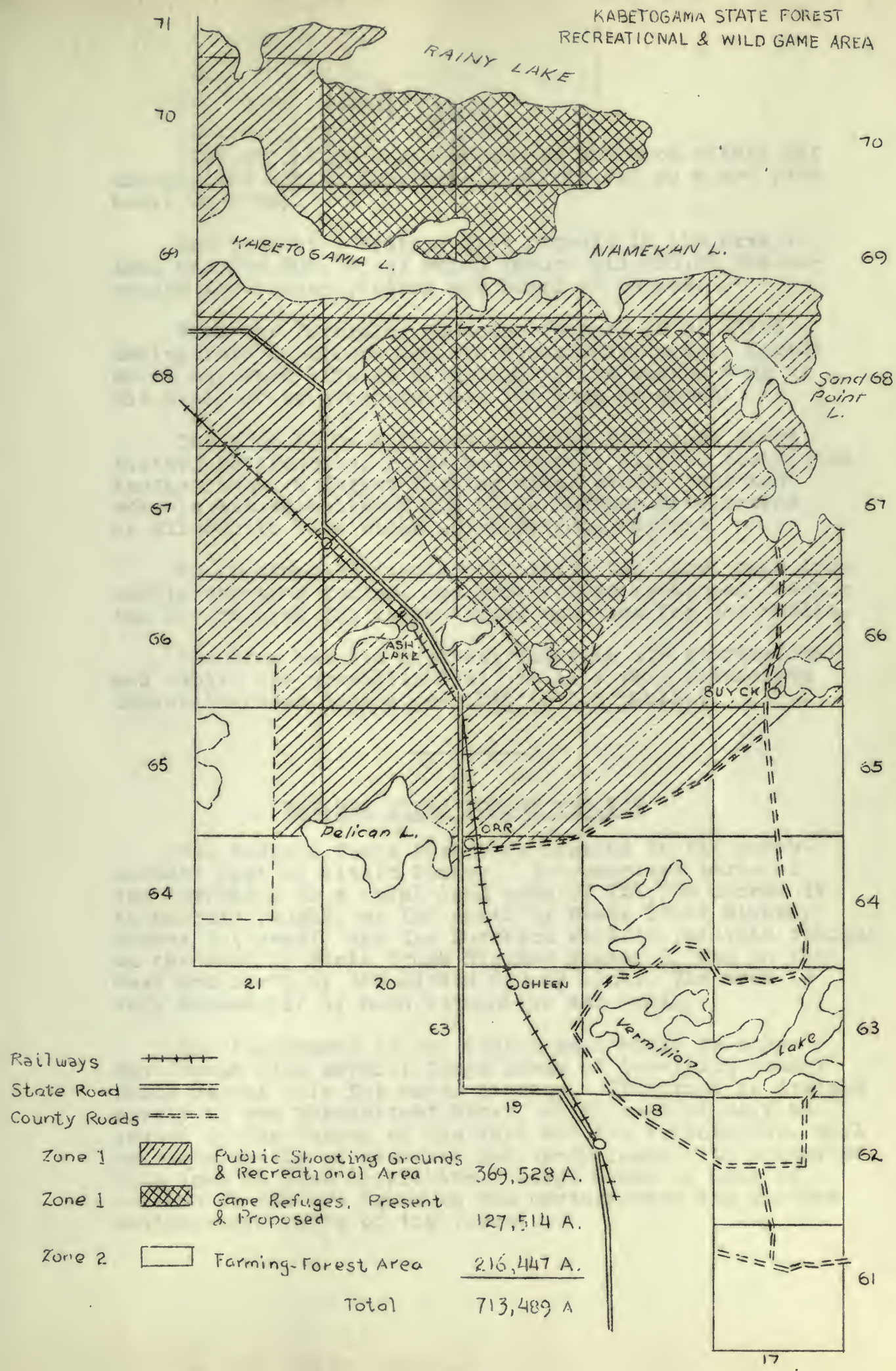
148,285 acres are in merchantable timber
514,114 " " " reproduction
21,000 " " barren
30,000 " " settled.

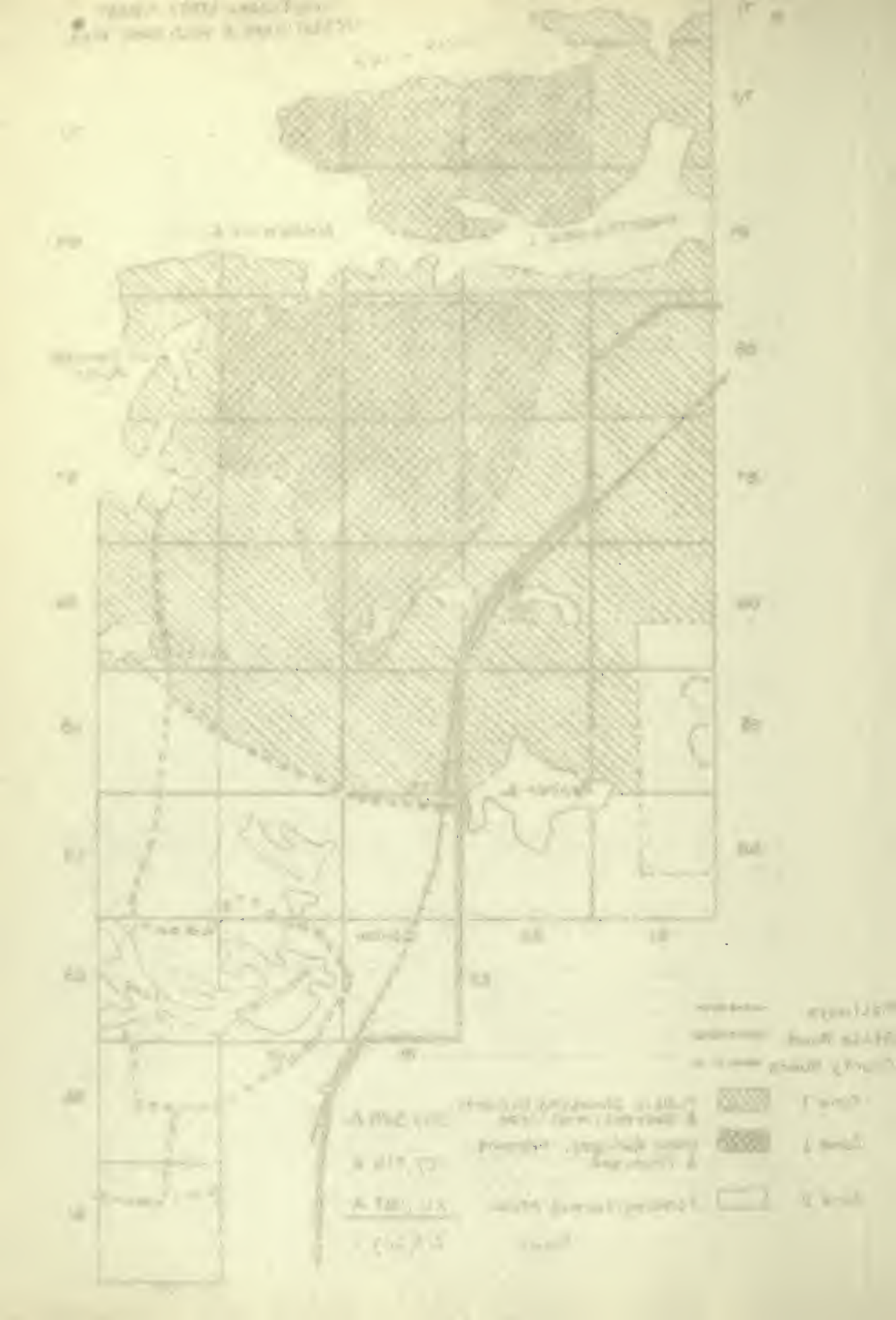
The total population of the area is 2,025, of which only 197 are in the transient centers within the area. There are 288 occupied farms and 147 abandoned farms in the area.

The average annual income for residents of the area is $430.55, divided as follows:

Income from Fed., County, State and U.S. Govt.	[illegible]
Income from farming	[illegible]
Income from miscellaneous sources	[illegible]
Income from timber	[illegible]
Income from sources dependent upon the forest	[illegible]

In addition to the taxes levied and collected in the taxing units in the area, there is an appurtenance from various other sources to the amount of $4,972.77 to that portion of the area within the organized school district No.9 (figures on a pro rata basis by area).


KABETOGAMA STATE FOREST
RECREATIONAL & WILD GAME AREA
RAINY LAKE
KABETOGAMA L.
NAMEKAN L.
Sand Point L.
ASH LAKE
SUYCK
Pelican L.
ORR
GHEEN
Vermilion Lake
71
70
69
68
67
66
65
64
63
62
61
21
20
19
18
17
Railways
State Road
County Roads
Zone 1 Public Shooting Grounds & Recreational Area 369,528 A.
Zone 1 Game Refuges, Present & Proposed 127,514 A.
Zone 2 Farming-Forest Area 216,447 A.
Total 713,489 A



$132,607.52 to that portion of the area within the unorganized school district (also figured on a pro rata basis by area).

The cost of operating five schools in the area in 1931 was $35,506.78, of which amount $11,330.90 was expended for transportation and board of pupils.

With the foregoing economic factors in mind and taking into consideration the topography, soils, forest cover and wild life as disclosed by the survey made of the area, it is proposed that the area be zoned:

One zone to be a forest and wild life zone where further settlements, roads and schools will be restricted. Another zone, a forest farming area, where roads and schools are established and where further development be allowed to take place as conditions warrant.

It is proposed further to divide the first zone into public shooting grounds and game refuge areas and develop the entire zone for recreational purposes for the public.

The area has its greatest value in its recreational and public use possibilities. It is a very attractive semi-wilderness area accessible to the public.

SAVANNA STATE FOREST PROJECT

The Savanna State Forest is located in the northeastern part of Aitkin County. It comprises parts of ten townships or a total land area of 191,736 acres. It is bounded roughly on the south by State Trunk Highway Number 2 (paved), and the Northern Pacific railroad tracks; on the west by State Trunk Highway Number 5; and on the east and north by the Aitkin County line. The area is very accessible by both automobile and train.

The topography of the region as a whole is somewhat rough with several large areas of low-lying swampy lands useful only for water storage. The tract is drained mostly by the Mississippi River, which runs closely adjacent to the forest on the west and its tributaries. Soil consists mostly of gravelly and sandy loams with a heavier clay loam in some localities. Large areas of peat of various depths are found in the northeastern and extreme southwestern parts of the forest.

$128,507.52 to meet portion of the area within the unorganized school district (also figured on a per-case basis by area).

The cost of operating five schools in the area in 1931 was $38,606.78, of which amount $11,320.80 was expended for transportation and board of rurals.

With the foregoing economic factors in mind and taking into consideration the topography, soils, forest cover and wild life as displayed by the survey made of the area, it is proposed that the area be grouped.

One zone to be a forest and wild life zone where further settlements, roads and schools will be restricted. Another zone, a forest farming area, where roads and schools are established and where further development be allowed to take place as conditions warrant.

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The topography of the region as a whole is somewhat rough with several large areas of low-lying swamp lands useful only for water storage. The trout is drained mostly by the Mississippi River, which runs closely adjacent to the forest on the west and its tributaries. Soil consists mostly of gravelly and sandy loams with a heavier clay loam in some localities. Large areas of that of various depths are found in the northeastern and extreme southwestern parts of the forest.

Land Ownership

State and other public land	9,933 A	- 5%
Private	112,523 A	-58%
Corporations	69,280 A	-37%
Total land area	191,736 A	

The present economic status of the area may be summarized as follows:

Tax Delinquency:

Trend of Tax Delinquency as shown by the Periods during which the land went delinquent

Prior to 1920	6,353.25	acres	3.2%
1920 - 1928	81,638.28	"	44.9%
1928 - 1931	44,612.19	"	24.9%
Total Tax Delinquency	132,603.72	"	73. %
Total Tax Paid	49,199.29	"	27. %
Total Taxable acres	181,803.00		100 %

Bonded Indebtedness:

Bonded indebtedness (1931)	$22,753.11
School bonded indebtedness	87,595.00
Total indebtedness	$110,348.11

Per Acre - 57¢.

Tax Collected and State Aid:

Total tax collected by local taxing units	$23,205.30
" " returned to state by local taxing units	5,925.05
" " returned from state to local units	19,464.77

Timber growth on the area is excellent and management for timber production will prove profitable.

Agricultural development is limited to the vicinity of the main roads although there are isolated settlers scattered throughout. There are about 5,000 acres under cultivation at present. Soils in some localities will support fair agricultural crops but in most cases are too stoney and the country too rough to make farming profitable.

Many of the settlers on the area at the present time derive their living from other sources than farming. An analysis of these sources was carried on with the following results and conclusions:

Land Ownership

State and other public land	9,904 A - 5%
Private	112,523 A -58%
Corporations	69,280 A -37%
Total land area	191,735 A

The present economic status of the area may be summarized as follows:

Tax Delinquency:

Trend of Tax Delinquency as shown by the Periods during which the land went delinquent

Prior to 1920	6,353.25 acres	3.3%
1920 - 1925	81,638.28 "	44.9%
1926 - 1931	44,613.32 "	24.5%
Total Tax Delinquency	132,805.72 "	73.7%
Total Tax Paid	49,189.28 "	27.3%
Total Taxable acres	181,803.00	100.0%

Bonded Indebtedness:

Bonded indebtedness (1931)	$23,753.11
School bonded indebtedness	87,585.00
Total indebtedness	110,343.11

Per Acre - 57¢.

Tax Collected and State Aid:

Total tax collected by local taxing units	$23,305.30
" " returned to state by local taxing units	5,925.05
" " returned from state to local units	19,984.77

Timber growth on the area is excellent and management for timber production will prove profitable.

Agricultural development is limited to the vicinity of the main roads although there are isolated settlers scattered throughout. There are about 5,000 acres under cultivation at present. Soils in some localities will support fair agricultural crops but in most cases are too stoney and the country too rough to make farming profitable.

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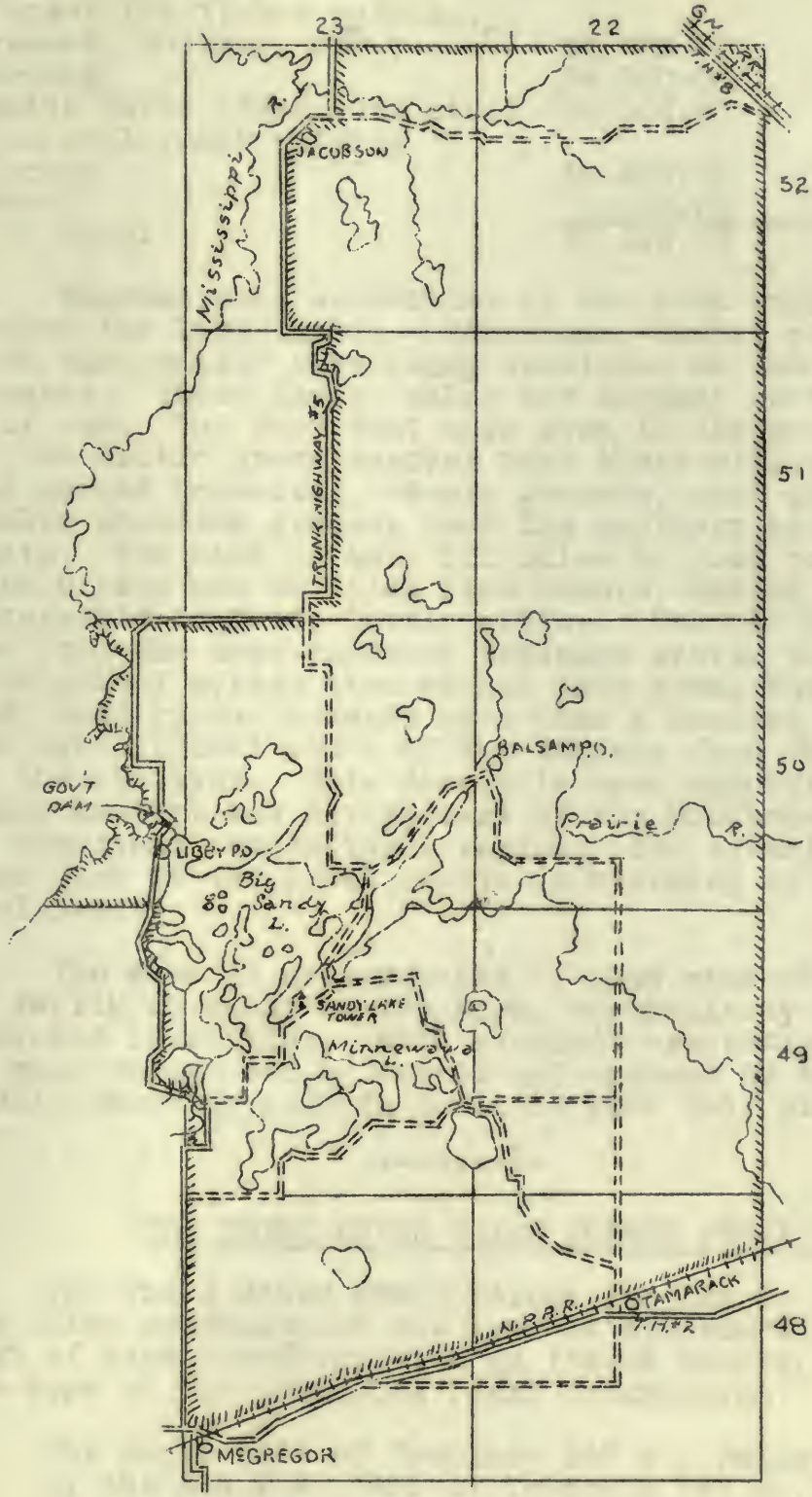
PROPOSED
SAVANNA STATE FOREST



Source of Income	Total Income	Percent
Income dependent upon forest (as timber cutting, resort, guiding, etc.)	$31,925.00	35.82
Farming	24,800.00	28.29
Public Works (road work, etc.)	16,908.60	18.97
From employment outside forest	10,480.00	11.69%
Other	5,000.00	5.23%
Total	89,113.60	100. %

Recreational activities on the area will center around the large lakes - Minnewawa, Sandy, and Aitkin, with the smaller ones being developed as the demand increases. These larger lakes are already developed for this use. The fact that this area is the southernmost of the entire group assures that there will be a demand for summer homesites, picnic grounds, camp grounds and public shooting grounds from the southern part of the state. The area is only 130 miles by good road from the Twin Cities and 65 miles from Duluth, making it reasonably accessible to these larger cities. The old Savanna Portage from the Lake Superior drainage system to that of the Mississippi system lies within this area, the route having been used by fur traders more than a hundred years ago and was the original route of the Indians from the Great Lakes to the prairies. This forest is most significant in the early history and development of the Northwest and is now an important recreational region. Its establishment will mean much to the local people in building up markets and employment.

The area is well adapted to game production which is fairly abundant on the area, particularly in the more isolated localities. With adequate protection afforded by game refuge and by proper enforcement of the game laws, public shooting grounds could be kept well stocked.

****

THE THIRD RIVER STATE FOREST PROJECT

The Third River State Forest Project is located ten miles southeast of the town of Blackduck and northwest of Lake Winnibigoshish in Itasca County, and includes the area of the following legal description:

> The north half of Township 147 N., Range 29 W. of the 5th P.M. All of Township 148 N., Range 29 W., and the south half of Township 149 N., Range 29 W.

Source of Income	Total Income	Percent
Income dependent upon forest (as timber cutting, resort, guiding, etc.)	31,925.00	38.82
Farming	24,500.00	25.26
Public Works (road work, etc.)	16,700.00	18.77
From employment outside forest	10,460.00	11.69
Other	5,000.00	5.60
Total	98,113.00	100. %

Recreational activities on the area will center around the large lakes - Kinnewana, Sandy, and Aitkin, with the smaller ones being developed as the demand increases. These larger lakes are already developed for this use. The fact that this area is the southernest of the entire group assures that there will be a demand for summer homesites, picnic grounds, camp grounds and public shooting grounds from the southern part of the state. The area is only 130 miles by good road from the Twin Cities and 85 miles from Duluth, making it reasonably accessible to these larger cities. The old Savanna Portage from the Lake Superior drainage system to that of the Mississippi system lies within this area, the route having been used by fur traders more than a hundred years ago and was the original route of the Indians from the Great Lakes to the prairies. This forest is most significant in the early history and development of the Northwest and is now an important recreational region. Its establishment will mean much to the local people in building up markets and employment.

The area is well adapted to game production which is fairly abundant on the area, particularly in the more isolated localities. With adequate protection afforded by game refuge and by proper enforcement of the game laws, public shooting grounds could be kept well stocked.

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The north half of Township 147 N., Range 29 W. of the 5th P.M. All of Township 148 N., Range 29 W., and the south half of Township 149 N., Range 29 W.

Land Ownership

Kind of Ownership	Acreages	Percent of Total Land Area
Private	29182.76	65.00%
Corporative	5926.35	13.20%
State Lands	8766.55	19.40%
Federal Lands and General Land Office	1111.45	2.40%

There are 20350.67 acres tax delinquent. This is 58.25 percent of the taxable land within the area. The Township of Moose Park, of which the south half is included in the proposed forest area, has a bonded indebtedness of $7,000.00. The total state taxes levied for the two towns, Moose Park and Third River, amounts to $375.27 in the year 1930. Total amount collected is $185.64 for the same year, or 49% of the levied amount.

Our survey shows that about 87 percent of the total land area is swamp or has a sandy soil not fit for any agricultural purpose. With the exception of the 541 acres under cultivation all of the area is forest land. 9899 acres or about 22 percent, has merchantable timber with a total volume of all species of about 64 million board feet. The remaining area has thrifty reproduction stands of which a great part is well advanced and in a few years will reach merchantable size.

At no time has there been any great change in the number of people living here since it was first settled about 1900. There are at the present time thirty-three settlers in this whole area with a total of 541 acres of cultivated land or 1.2 percent of the total land area. This alone gives a strong indication that this land is not adapted for any extensive agricultural development. Only eight of the settlers depend to any extent on farming for a living. Three are owners of and operate small sawmills, and three have some income from the operation of summer resorts and renting cabins to tourists and hunters. The remaining settlers are dependent upon occasional jobs in the woods or in the sawmills, road jobs with the county or township, and the game for a living.

The average income of the wage earners is $486.33 a year, earned from five sources, as follows:

Land Ownership

Kind of Ownership	Acreages	Percent of Total Land Area
Private	[illegible]	[illegible]
Corporation	[illegible]	[illegible]
State Lands	[illegible]	[illegible]
Federal Lands and General Land Office	[illegible]	[illegible]

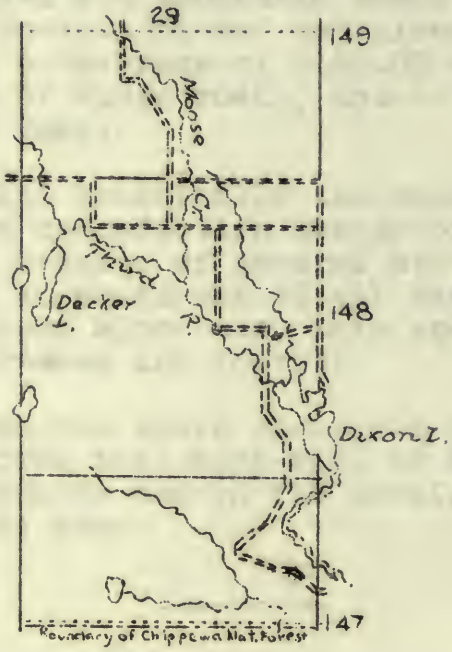
There are [illegible] acres tax delinquent. This is [illegible] percent of the taxable land within the area. The Township of Moose Park, of which the south half is included in the proposed forest area, has a bonded indebtedness of $7,000.00. The total state taxes levied for the two towns, Moose Park and Third River, amounts to $[illegible] for the year 1930. Total amount collected is $[illegible] for the same year, or 49% of the levied amount.

Our survey shows that about [illegible] percent of the total land area is under or has a sandy soil not fit for any agricultural purpose. With the exception of the [illegible] acres under cultivation all of the area is forest land. [illegible] acres or about [illegible] percent, has merchantable timber with a total volume of all species of about [illegible] million board feet. The remaining area has thrifty reproduction stands of which a great part is well advanced and in a few years will reach merchantable size.

At no time has there been any great change in the number of people living here since it was first settled about 1900. There are at the present time thirty-three settlers in this whole area with a total of [illegible] acres of cultivated land or 1.[illegible] percent of the total land area. This alone gives a strong indication that this land is not adapted for any extensive agricultural development. Only eight of the settlers depend to any extent on farming for a living. There are centers of [illegible] operation small sawmills, and three have some income from the operation of summer resorts and rooming [illegible] to tourists and hunters. The remaining settlers are dependent upon occasional jobs in the woods or in the sawmills, road jobs with the county or township, and the game for a living.

The average income of the [illegible] is $[illegible] a year, earned from five sources, as follows:

PROPOSED
THIRD RIVER STATE FOREST



U.S., State, County, Township	$136.17	- 28%
Farming	111.85	- 23%
Timber	160.48	- 33%
Trapping, Resorts, etc.	72.94	- 15%
Miscellaneous employment	4.89	- 1%
	$486.33	

The area has several good roads, of which seven miles are County roads, twenty miles are Township roads and about 18 miles are secondary roads, constructed mainly for logging operations and not given any special maintenance. Using an average of $150.00 per mile a year for maintenance of these roads, the total cost amounts to $4050.00 per year.

The fact that practically the whole area has unburned merchantable and reproduction stands of the different timber species and because of several attractive lakes, rivers and streams and an abundance of all the different varities of game of Northern Minnesota, this area is a paradise for the hunter, sportsman and tourist.

Judging from the above facts, it is no doubt that the largest return from this area will be had from timber and other forest products and in the development of this region as a recreational area.

THE WHITE EARTH STATE FOREST PROJECT

The area embraced in this survey involves 289,719.48 acres or twelve full townships and parts of five others located in Becker, Clearwater and Mahnomen Counties. It is bounded on the east by Itasca State Park and the east line of the west tier of sections of Townships 144 and 142, R. 36. The Mallard-Roy Lake Mahnomen Highway forms the north boundary. The south boundary may be described by a line running westward from the north edges of the Ponsford Prairie in Township 141, R. 37, touching the north end of Round Lake and through Sugar Bush Lake. The west side is bounded by the prairie region or those parts where the encroachment of cultivated lands into the forest form an irregular line in the tier of townships in Range 20. The region as a whole is extremely rough and hilly, much of it uninhabited.

Total land Area (exclusive of water)	268,664.43 acres
State, U.S., Indian Trust Lands Non-taxable	15,535.74 acres
Taxable Land Area	253,128.69 acres.

Approximately 166,344 acres or 65.71 percent of the taxable land area is now delinquent. Two townships within the area have a delinquency of over 85 percent. The gradual trend is towards greater delinquency. Previous to 1920, 24,733.72 acres or 9.77% of the taxable land area went delinquent. During the period 1920 to 1928 an additional 102,479.89 acres, or 40.49% became delinquent. Between the period 1928 to 1930 inclusive 39,131.21 acres more went delinquent or 15.45 percent. Only 86,783.87 acres or 34.29 percent of the taxable land is now paying taxes. Up to and including the year 1930, the tax records show $289,004.31 unpaid taxes for this area.

The area covered by this survey carries an indebtedness of $99,593.79, or approximately 39 cents per acre. Some of the loans are due now; others are payable in the next two to ten years.

Over 70 percent of the land area is privately owned, of which corporations, including banks, land companies, former lumber companies, etc., hold 23.49 percent. The state holds 1.77 percent; the Federal Government 1.20 percent; and Indian trust lands 2.81 percent. Lands owned for recreational purposes amount to .05 percent.

Present Cover Types and the Percent of Area each occupy are as follows:

Improved Land Types	3.35%
Lakes and Ponds	8.12%
Upland Timber Types	66.63%
Highland Brush and open wild land	10.50%
Swamp Timber Types	7.01%
Swamp brush and Open Marsh	4.39%

A large part of the area is covered with dense stands of young growth, but there is enough large timber in the area to pay a sizeable return from the very start. Almost 15% of the land area is covered with merchantable stands having a total volume of 56,539,000 cubic feet.

Practically all the land covered by this survey was forest land, but a portion of the area situated on the west border was excluded from the proposed state forest boundaries because of present and possible future development of agriculture in that locality. Agricultural

Total Land Area (exclusive of water)	244,[illegible] acres
State, U.S., Indian Trust Lands	
Top-taxable	18,[illegible] acres
Taxable Land Area	[illegible] acres

Approximately 150,[illegible] acres or 58.71 percent of the taxable land area is now delinquent. The taxables within the area have a delinquency of over [illegible] percent. The gradual trend is towards greater delinquency. Previous to 1930, 24,733.72 acres or 9.77% of the taxable land area went delinquent. During the period 1930 to 1938 an additional 102,[illegible] acres, or 40.[illegible]% became delinquent. Between the period 1938 to 1950 inclusive 38,[illegible] acres more went delinquent or 15.48 percent. Only [illegible] acres or 24.[illegible] percent of the taxable land is not paying taxes. Up to and including the year 1950, the tax records show [illegible],004.[illegible] unpaid taxes for this area.

The area covered by this survey carries an indebtedness of [illegible], or approximately [illegible] acres per acre. Some of the loans are due now; others are payable in the next two to ten years.

Over [illegible] percent of the land area is privately owned, of which corporations, including banks, land companies, former lumber companies, etc., hold [illegible] percent. The state holds 1.[illegible] percent; the Federal Government [illegible] percent; and Indian trust lands 2.[illegible] percent. Lands owned for recreational purposes amount to .[illegible] percent.

Present Cover Types and the Percent of Area each occupy are as follows:

Improved Land Types	[illegible]
Lakes and Ponds	[illegible]
Upland Timber Types	[illegible]
Highland Brush and open wild land	[illegible]
Swamp Timber Types	[illegible]
Swamp Brush and Dead Marsh	[illegible]

A large part of the area is covered with dense stands of young growth, but there is enough large timber in the area to pay a sizeable return from the very start. Almost [illegible]% of the land area is covered with merchantable stands having a total volume of [illegible],000 cubic feet.

Practically all the land covered by this survey was forest land, but a portion of the area situated on the west border was excluded from the proposed state forest boundaries because of present and possible future development of agriculture in that locality. Agricultural

development in this area is confined principally to four small farm communities situated on the border regions. Approximately 9,600 acres, or 3.35 percent of the total area is improved land. Less than 50 percent of this is included in the proposed forest. The stoniness of the land, together with the extremely rough topography makes practically all of the area so included unfit for agricultural purposes.

The present population is 1612 people, and are found living principally in the extreme border region. A high percentage of the population is Chippewa Indian.

The average income from all occupations for all heads of families living in the forest is $453.40, divided as follows:

Income from U.S., State, County and Twp.	$163.36
Income from timber operations	85.78
Income from farming	76.67
Income not farm nor dependent on forest (Includes stores, employment outside forest, etc.)	68.52
Income from occupations dependent upon forest, such as trapping, guiding, resorts, berry picking, etc.	59.07

There are fourteen organized and three unorganized school districts within this area which incorporate fourteen operating rural schools.

The following table briefly summarizes the school situation:

Enrollment 1930-31	Cost per Pupil 1930-31	Cost of Operating School 1930-31	School Tax Collected 1930	Value of School Prop. 1930-31
301	$56.46	$16,994.73	$9,608.79	$43,144.00

This area has approximately 24 miles of State Aid Road, and 102 miles of Township Roads. In addition to this, there are 164 miles of passable trails that have no official supervision or maintenance. Average annual cost of construction and maintenance to the townships on the above roads is $6,350.00.

As well as a timber forest, the area presents wonderful recreational possibilities, having over a hundred lakes, many of them very attractive.

Development in this area is confined principally to that small farm communities situated on the border regions. Approximately 9,000 acres, or 3.25 percent of the total area is improved land. Less than 50 percent of this is included in the reserved forest. The stockings of the land, together with the extremely rough topography, make practically all of the area so included unfit for agricultural purposes.

The present population is 1212 people, and are found living principally in the extreme border region. A high percentage of the population is Chinese Indian.

The average income from all occupations for all areas of families living in the forest is $453.40, divided as follows:

Income from U.S., State, County and Twp.	$160.36
Income from timber operations	88.78
Income from farming	78.57
Income not farm nor farm/not in forest (includes vacuum, employment outside forest, etc.)	68.52
Income from occupations (employment area forest, such as trapping, guiding, resorts, berry picking, etc.	88.07

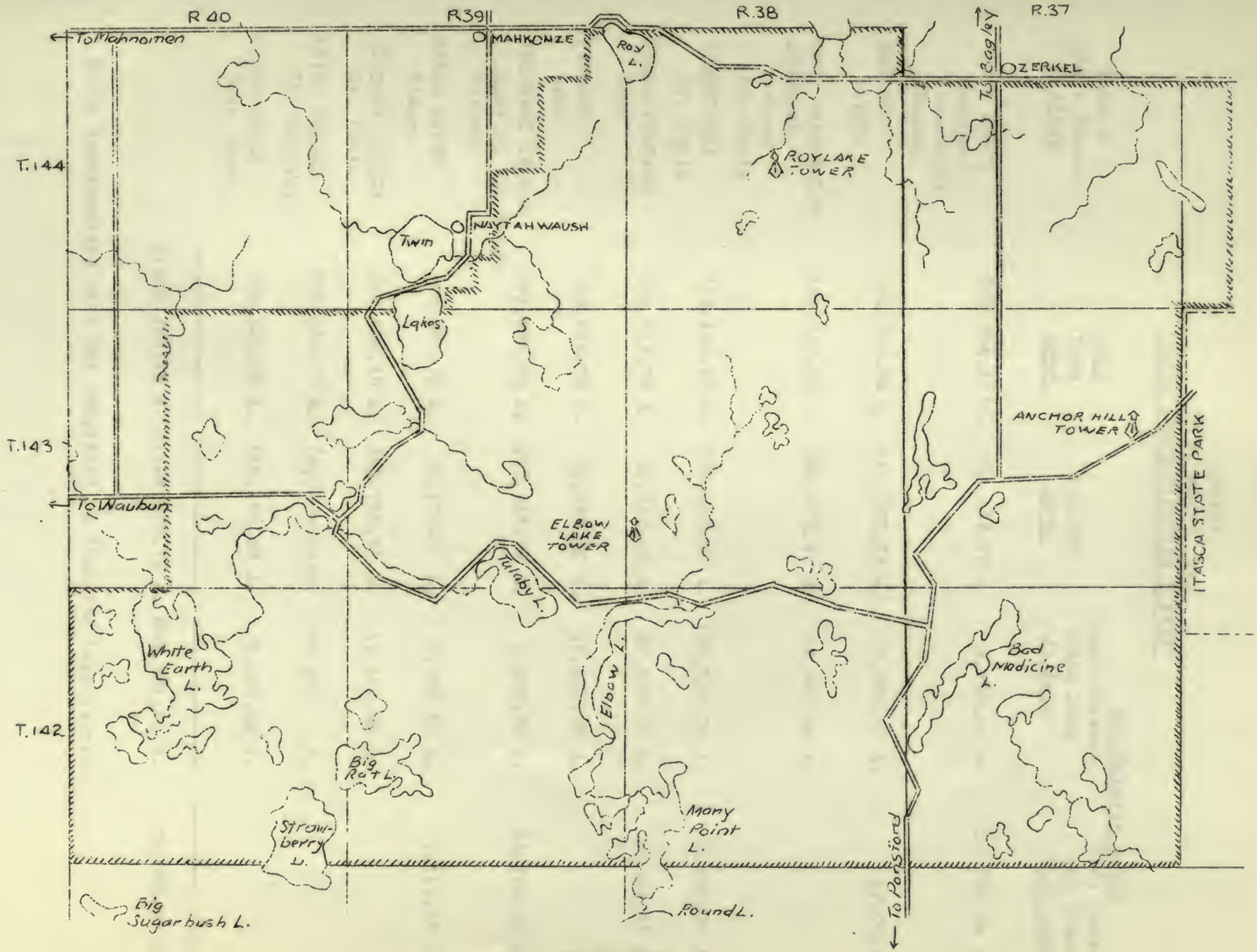
There are fourteen organized and three unorganized school districts within this area which incorporate fourteen operating rural schools.

The following table briefly summarizes the school situation:

Enrollment 1930-31	Cost per Pupil 1930-31	Cost of Operating School 1930-31	School Tax Collected 1930	Value of School Prop. 1930-31
301	[illegible]	[illegible]	[illegible]	[illegible]

This area has approximately 24 miles of State Aid Road, and 108 miles of Township Road. In addition to this, there are 194 miles of passable trails that have no official supervision or maintenance. Average annual cost of construction and maintenance to the township on the above roads is $3,380.00.

As well as a timber forest, the area presents numerous recreational possibilities, having over a hundred lakes, some of them very attractive.



PROPOSED
WHITE EARTH STATE FOREST

SUMMARY
OF ECONOMIC DATA
LAND CLASSIFICATION SURVEY

Name of State Forest Project	Total Land Area	Taxable Area	Non-Taxable Lands: Total Acreage State Land In Area	Non-Taxable Lands: U.S. Indian and Other U.S. Land
WHITE EARTH Mahnomen Clearwater Becker	268,664.43 A.	253,128.69 A.	4,749.10 A.	10,786.64 A.
SAVANNA Aitkin	191,736.04 A.	181,803.34 A.	9,905.70 A.	27.00 A.
GEO. WASHINGTON MEMORIAL Itasca St. Louis	339,743.31 A.	266,973.46 A.	72,769.85 A.	
KABETOGAMA St. Louis	713,489.00 A.	575,573.00 A.	135,516.00 A.	2,400.00 A.
GRAND PORTAGE Cook	153,514.78 A.	99,313.08 A.	27,602.19 A.	26,599.51 A.
FINLAND Lake	48,648.00 A.	38,360.00 A.	10,288.00 A.	
BELTRAMI ISLAND Lake of the Woods Roseau	364,495.98 A.	322,815.98 A.	2,920.00 A.	38,760.00 A.
THIRD RIVER Itasca	44,987.11 A.	35,109.11 A.	8,766.55 A.	1,111.45 A.
CLOQUET VALLEY St. Louis	218,137.40 A.	206,738.57 A.	11,398.83 A.	
*PINE ISLAND Koochiching	368,640.00 A.	(Approximate)	306,202. A.	
*FOOT HILLS Cass County	150,328.13 A.	145,144.49 A.	5,183.64 A.	
	2,862,384.18 A.	2,124.959.72 A.	595.301.86 A.	79,684.60 A.

* Field examinations were not completed in time for this report.

[illegible]

[illegible]

Name of State Forest Project	Total Land Area	Tenable Area	Total Average State Land in Acres	Non-Tenable Lands U.S. Lands and Other U.S. Land
[illegible] Mahomet Clearwater Becker	[illegible] A.	[illegible] A.	[illegible] A.	[illegible] A.
[illegible] Adams	[illegible] A.	[illegible] A.	[illegible] A.	[illegible] A.
[illegible] Franklin St. Louis	[illegible] A.	[illegible] A.	[illegible] A.	
[illegible] St. Louis	[illegible] A.	[illegible] A.	[illegible] A.	[illegible] A.
[illegible] Cook	[illegible] A.	[illegible] A.	[illegible] A.	[illegible] A.
[illegible] Lake	[illegible] A.	[illegible] A.	[illegible] A.	
[illegible] Lake of the Woods Ottawa	[illegible] A.	[illegible] A.	[illegible] A.	[illegible] A.
[illegible] Franklin	[illegible] A.	[illegible] A.	[illegible] A.	[illegible] A.
[illegible] St. Louis	[illegible] A.	[illegible] A.	[illegible] A.	
[illegible] Knockbinding	[illegible] A.	[illegible]	[illegible] A.	
[illegible] Dent County	[illegible] A.	[illegible] A.	[illegible] A.	
	[illegible] A.	[illegible] A.	[illegible] A.	[illegible] A.

* Field examinations were not completed in time for this report.

SUMMARY
OF ECONOMIC DATA
LAND CLASSIFICATION SURVEY

Name of State Forest Project	Acres Delinquent	Percent of Taxable Land Delinquent	1930 Bonded Indebtedness	Acres of Improved Farm Crop and Pastures	Population
White Earth	166,344.82 A.	65.71%	$99,160.79	9,694.00	1,612
Savanna	132,603.72 A.	73.00%	110,348.11	5,188.00	966
Geo. Washington Memorial	138,768.94 A.	52.00%	18,087.41	7,614.00	1,181
Kabetogama	360,000.00 A.	63.00%	6,374.62	20,367.00	2,035
Grand Portage	49,774.68 A.	50.00%	11,000.00	915.00	646
Finland	18,168.00 A.	47.10%	4,707.19	90.00	600
Beltrami Island	243,825.00 A.	75.50%	13,593.23	15,000.00	1,495
Third River	20,350.00 A.	58.25%	5,318.00	611.00	134
Cloquet Valley	176,509.95 A.	85.00%	20,871.49	415.00	146
	1,306.345.11 A.	65.98%	289,460.84	59,894.00	8,815

CONTRACT
OF PRODUCTIVE DATA
BASED ELECTRICALLY ACTIVE

Name of Power Project	Area Submerged	Income Total Expenditure	Gross Actual Capacity-Kilowatts	Income of Impounded Water Over Expenditure	Total-Cost
Pirity Falls	$ 16,188,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bryanton	$ 27,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Port Washington Memorial	$ 40,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cabrillo	$ 50,000,000	[illegible]	[illegible]	[illegible]	[illegible]
Great Fretage	$ 49,777,69	[illegible]	[illegible]	[illegible]	[illegible]
Ellsland	$ 10,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Twisted Island	$ 10,000,00	[illegible]	[illegible]	[illegible]	[illegible]
Lake River	$ 20,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Clover Valley	$ 49,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	$ 17,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

S U M M A R Y

SOURCE OF INCOME BY AMOUNTS AND PERCENTS ACCORDING TO OCCUPATION OF POPULATION IN EIGHT FOREST PROJECTS - 2,208,000 ACRES

		Dependents	Income from U.S. County, State, Twp.	% of Total Income	Income from Farming	% of Total Income	Income from Timber Operations	% of Total Income	Income Other F est Occupation Trapping, Resor Berry Picking	% of Tota Inco
650	Settlers Farmers	1,836	$74,984	27%	$116,009	41%	$37,920	14%	$17,060	6%
225	Laborers Pub.Officers Truckers etc.	466	57,477	60%	3,534	4%	7,342	8%	4,517	5%
215	Shackers Fur Farmers Trappers etc.	499	20,194	32%	7,925	12%	6,735	11%	13,013	21%
22	Timber Oper. Milling Logging etc.	50	1,013	2%	513	1%	35,475	86%	2,804	7%
64	Resort Owners	123	3,019	5%	1,340	2%	1,030	2%	46,705	82%
31	Storekeepers	70	2,106	6%	550	1%	1,640	5%	2,792	8%
1,207	Total	3,044	$158,793	28%	$129,921	23%	$90,142	16%	$86,891	15%

31%

[illegible]

[illegible]

[illegible]

The following is copied from "A Forest Policy and Program for the State of Minnesota", released in January, 1931, by the Director of Forestry, copies of which were distributed to members of the legislature at the 1931 session. These principles apply quite closely to the present proposed state forests and might well be re-read at this time:

"STATE FORESTS

General Recommendations

The state now owns approximately two million acres of trust fund lands distributed largely through the northern counties of the state. Lands previously sold by the state are continually reverting and will increase the amount of state trust lands for some time to come. Regardless of the amount of state forests, public shooting grounds and game refuges and lands for other public use that are set aside from these trust fund lands, there will always be a large acreage scattered over the state which should be kept subject to sale for agricultural uses where they are within settlement regions. Much of the trust fund land is mineralized and there will always be a certain area under lease for either prospecting or mining. Water reservoirs and other public utility purposes will no doubt require the use of a limited amount of state lands. Many thousands of acres will not be suited for state forest purposes. Such property should be handled as a public domain, separate and apart from organized state forests.

State forests as dealt with or outlined in this program are therefore state school and swamp lands withdrawn from sale under Chapter 447, Laws of 1917, and Chapter 246, Laws of 1927, or succeeding similar acts, and any other state lands subsequently set aside or acquired through tax title, purchase or gift for such purposes.

1. A two million acre program of consolidated state forests, public shooting grounds and game refuges and recreational areas should be started at once for completion by 1940; one million acres to be made up from existing state forests and from other state lands withdrawn from sale and designated as forests, (there are now 400,000 acres in state forests but not consolidated), and one million acres to be acquired at the rate of 100,000 acres every year through a regular acquisition program. The report of examination of twelve of these proposed forests has been made. These areas are made up of 380,440 acres of lands of the public domain, 411,005 acres tax delinquent private lands (1928 records) 654,818 acres of lands necessary for acquisition from private owners, and 20,720 acres requiring purchase from or exchange with the federal government (Indian Department).

2. State forests to be of the greatest value to the public and to permit the most economical management, should not be less than 2,500 acres of contiguous lands and preferably 50,000 acres or more.

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2. State forests to be of the greatest value to the public and to permit the most economical management, should not be less than 2,500 acres of contiguous lands and preferably 50,000 acres or more.

3. In order that the greatest development can be made in these state forests, they should be located in areas or regions best adapted to their rehabilitation.

4. Lands of low quality should not be selected for state forests except to fill out and make contiguous, areas of state forests.

5. State forests should be located near or at the edge of farming communities and centers of population so that the greatest number of people may receive the benefits of them.

6. An immediate acquisition and consolidation program should be started before such lands are selected for other purposes, including purchase by the federal government. Acquisition should be made by purchase, condemnation, tax title, (Amendment of Chapter 119, Laws of 1927), gift, or exchange with federal government.

7. Twenty-five percent of the forest lands of the state, or approximately four million acres, should ultimately be in organized state forests.

8. Organized and consolidated state forests will permit of the most intelligent and efficient management of the lands for timber production, public shooting grounds, game refuges and recreational purposes.

9. The greatest amount of merchantable timber possible should be produced in conjunction with other forest uses.

10. Manage and establish so as to better sustain local industry, provide winter employment for surplus farm labor and teams and a market for produce.

11. Cut state forests only on a sustained yield basis.

12. Manufacture forest products from state forests within the state. In the sale of products from state forests, Minnesota industries to be favored.

13. Harvest all timber crops so as to best encourage advance and future natural regeneration.

14. Cut and manage the forest in such a manner as to make it safer from fire, disease and insect infestations.

15. Improve stand by selective logging of species and artificial planting.

16. Where good management will permit state forests should favor larger sized timber that private capital cannot afford to grow.

17. White pine, Norway pine and white spruce, being the most valuable species in our northern forests, should be grown wherever possible.

18. Secure the greatest cash revenues and returns from all possible sources not inconsistent with the best management of the forest.

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18. Secure the greatest cash revenues and returns from all possible sources not inconsistent with the best management of the forest.

19. Management plans of state forests should consider allclasses of timber industries such as Christmas trees, novelties, decorations, in addition to pulp,lumber, etc.

20. Watershed protection for water power, navigation, aquatic life and domestic purposes is important and should have first place in any management.

21. Since recreation is one of the important sources of income within the state, forests should be developed and managed with this use in view.

22. Along with public shooting grounds and game refuges other recreational uses should be developed by providing for public camp grounds, summer homesites, tourist travel, protection of scenic beauty on the roads, lakes and streams, and for other general public use.

23. As a reinbursement for the possible taxes lost on account of the withdrawing from sale of any state forest land, an annual tax or revenue of 5 cents per acre should be paid thetaxing district on all state forest lands, public shooting grounds and game refuges. Such payment should be based on productive or planted lands and not on burnt over, barren or denuded areas.

ADDITIONS

As this condensed report of the land examination activities on the nine proposed projects is being submitted, the preliminary report of the findings of the work on the Pine Island Forest in Koochiching County and the Foot Hills Forest in Cass County has been received and examined but not in time to add it to this report. The findings show that certain portions of these lands are very desirable as "state conservation zones" and should be considered in the enlarged project, making eleven in number instead of nine, as herein discussed A supplementary report on these will be available soon.

19. Management plans of state forests should provide allotment of timber industries such as Christmas trees, operations, decorations, in addition to pole, lumber, etc.

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ADDITIONS

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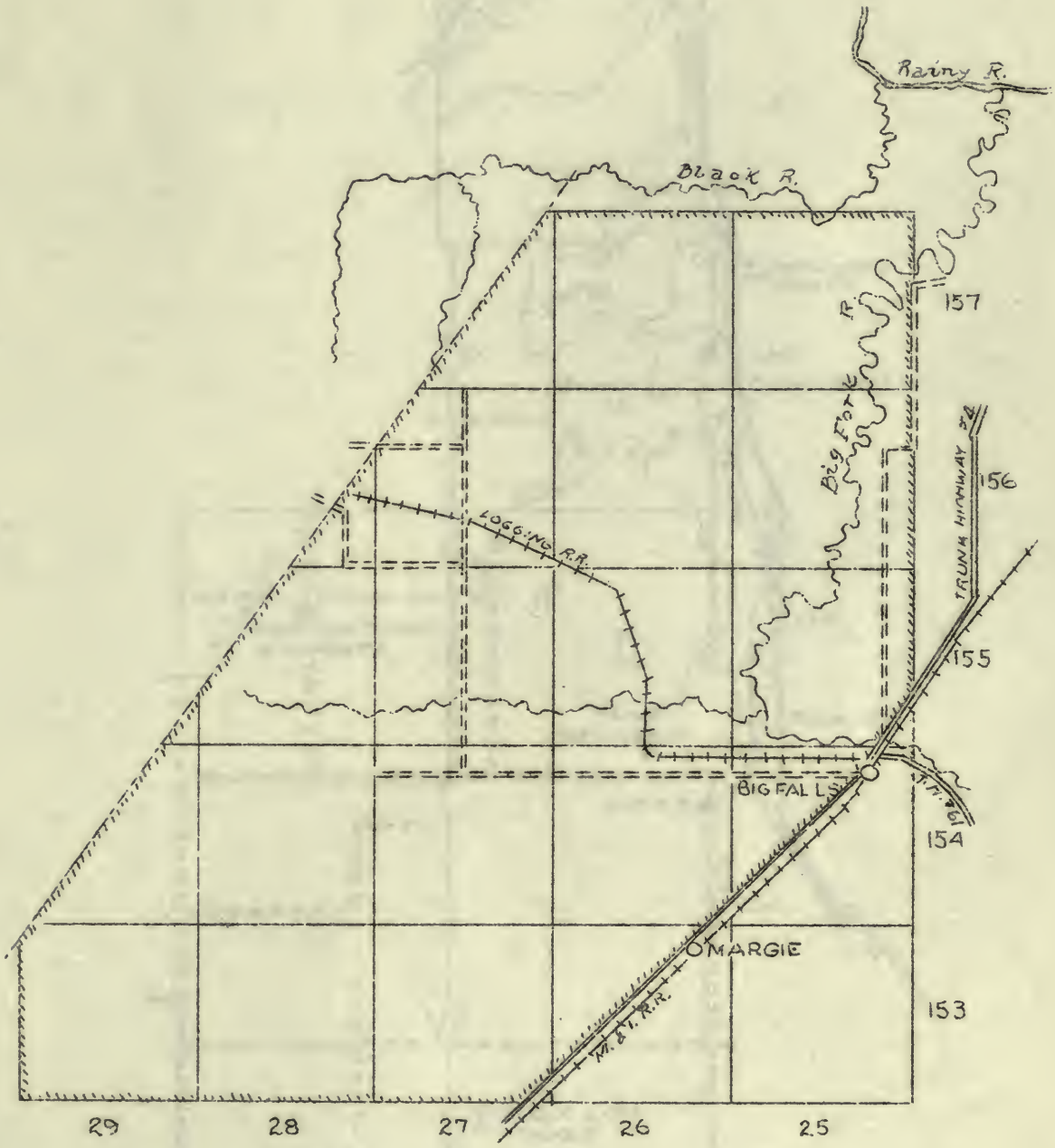
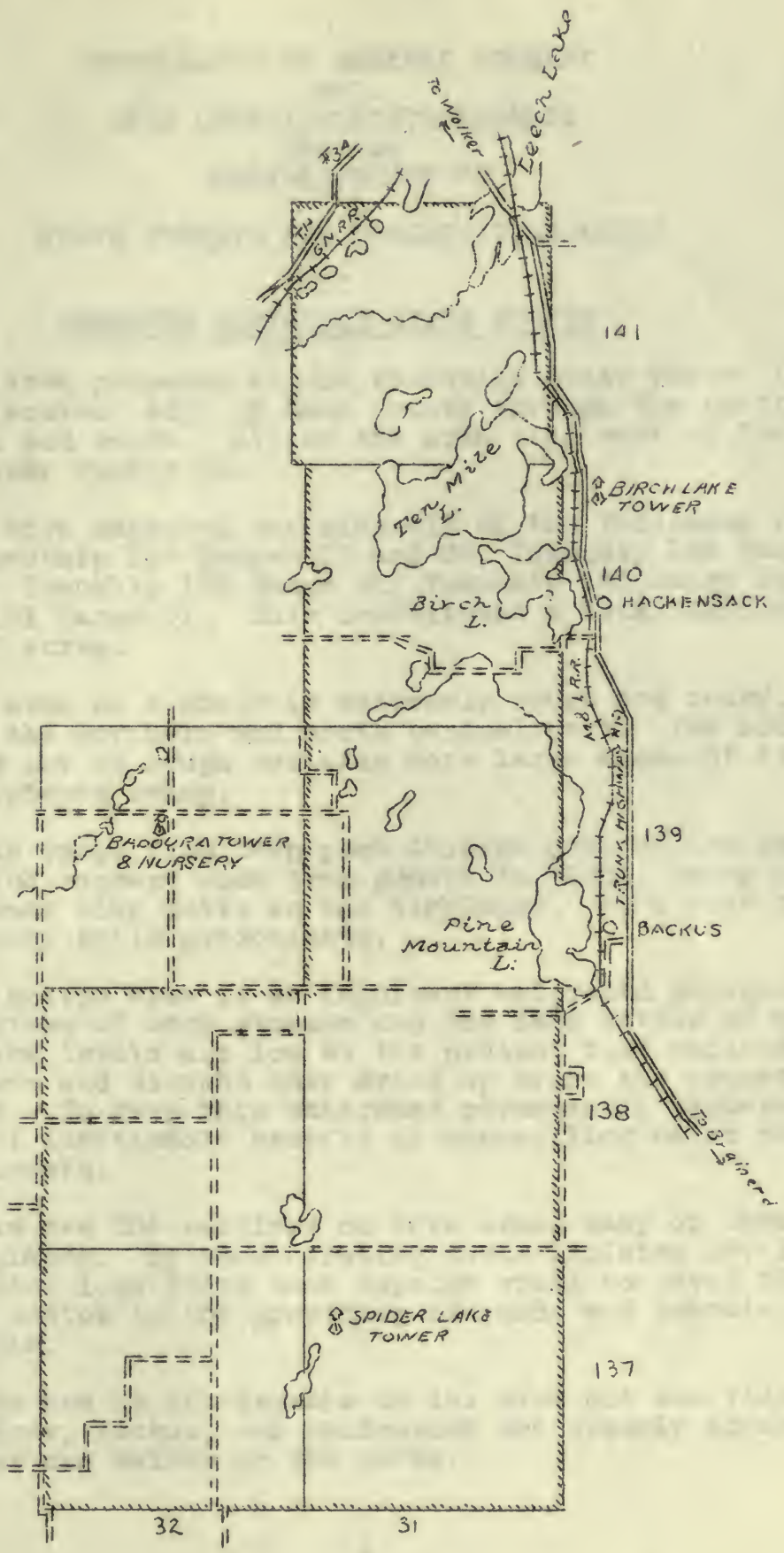
PROPOSED
PINE ISLAND STATE FOREST



PROPOSED
FOOTHILLS STATE FOREST



SUPPLEMENT TO GENERAL SUMMARY
of
LAND CLASSIFICATION REPORTS
for the
ESTABLISHMENT OF

STATE FORESTS AND CONSERVATION AREAS

PROPOSED FOOTHILLS STATE FOREST

The area proposed as the Foothills State Forest lies along the western edge of Cass county through the central portion north and south. All of the area lies west of State Trunk Highway Number 19.

The area selected contains all of the following townships: Township 137 Ranges 31 and 32, Township 138 Ranges 31 and 32, Township 139 Range 31, Township 140 Range 31 and Township 141 Range 31. This constitutes a total land area of 150,328.13 acres.

The area as a whole is extremely rough and rocky, particularly the northern and north central part. The southern part while not as rough contains more large areas of treeless or semi-timbered swamp.

Soils range from deep peat through peat of the shallow stages which support some tree growth to light, sandy or heavier sandy clay soils on the highlands. As a rule the lighter sandy soils predominate.

The entire area is an important watershed controlling the headwaters of many streams and the lake levels of many lakes. Lake levels are low at the present time while many former lakes and sloughs have dried up since the removal of the timber. To keep this watershed permanently timbered would be of inestimable benefit in controlling water runoff and lake levels.

There are 204 settlers on this area, many of them in isolated places. By concentrating these isolated settlers in the better localities much expense would be saved the governing bodies in the providing of roads and schools for these people.

There are no settlements on the area but the villages of Pine River, Backus, and Hackensack are closely adjacent on the east and Walker on the north.

SUPPLEMENT TO GENERAL SUMMARY
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The area proposed as the Foothills State Forest lies along the western edge of Cass county through the central portion north and south. All of the area lies west of State Trunk Highway Number 19.

The area selected consists all of the following townships: Township 137 Range 31 and 32, Township 138 Ranges 31 and 32, Township 139 Range 31, Township 140 Range 31 and Township 141 Range 31. This constitutes a total land area of 180,398.13 acres.

The area as a whole is extremely rough and rocky, particularly the northern and north central part. The southern part while not as rough contains more large areas of treeless or semi-timbered swamp.

Soils range from deep peat through peat of the shallow stages which support some tree growth to light, sandy or heavier sandy clay soils on the highlands. As a rule the lighter sandy soils predominate.

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There are 204 settlers on this area, many of them in isolated places. By concentrating these isolated settlers in the better localities such expense would be saved the governing bodies in the providing of roads and schools for these people.

There are no settlements on the area but the villages of Pine River, Backus, and Hackensack are closely adjacent on the east and Walker on the north.

Most of the settlers attempt to make a living by farming, but many find it necessary to supplement their income by hunting, trapping, and timber cutting. Some of them work in the nearby towns, on road work, or on school bus transportation.

The proposed forest has many possibilities from a recreational standpoint. There are several lakes of a larger size and many smaller ones on the area. Most of these have timbered highland shorelines with good possibilities for the development of public picnic and camp grounds as well as summer homes and resorts.

Much of the country furnishes excellent cover for game and wildfowl. There is at present a game refuge of about 28,800 acres within the proposed forest. It includes all but the extreme western tier of sections in Township 139 Range 31, five sections in the southern part of Township 140, Range 39 and ten sections in the northern part of Township 139 Range 31. In addition to this refuge which is already established a part of Township 137 Range 32 should be set aside for this purpose with most of the remaining area as public shooting grounds.

A large forest and recreational area of this kind would undoubtedly benefit the settlers and townspeople of the surrounding country by the attraction of tourists and permanent summer residents thereby enlarging markets and increasing tax receipts.

Economic Conditions Affecting Area

The following are some pertinent economic facts relating to the area:

Tax delinquency for the area is extremely high, 66.2% (Table I) of the total amount of taxable land within the area being delinquent one year or more. Of this approximately 42% has been delinquent five years or more and will revert to the state in trust for all interested taxing bodies in 1933 under Chapter 119, Laws of 1927.

Bonded indebtedness is also high, being a total of $145,019.98 for the entire area, or over $.90 an acre. (Table II) The assessed valuation is $571,993.00, or $3.80 per acre, which is also high. (Table III).

The total tax levied for the year 1930 was $73,575.60.

Most of the settlers attempt to make a living by farming, but many find it necessary to supplement their income by hunting, trapping, and timber cutting. Some of them work in the nearby towns, on road work, or on school bus transportation.

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Much of the country furnishes excellent cover for game and wildfowl. There is at present a game refuge of about 28,000 acres within the proposed forest. It includes all but the extreme western tier of sections in Township 138 Range 31, five sections in the southern part of Township 140, Range 29 and ten sections in the northern part of Township 139 Range 31. In addition to this refuge which is already established a part of Township 137 Range 32 should be set aside for this purpose with most of the remaining area as public shooting grounds.

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Economic Conditions Affecting Area

The following are some pertinent economic facts relating to the area:

Tax delinquency for the area is extremely high, 55.2% (Table I) of the total amount of taxable land within the area being delinquent one year or more. Of this approximately 42% has been delinquent five years or more and will revert to the state in trust for all interested taxing bodies in 1938 under Chapter 119, Laws of 1927.

Bonded indebtedness is also high, being a total of $343,019.98 for the entire area, or over $.40 an acre. (Table II) The assessed valuation is $571,885.00, or $2.60 per acre, which is also high. (Table III).

The total tax levied for the year 1930 was $73,575.60.

Of this amount, $29,108.79 was actually collected, or 40%, leaving 60% delinquent by amount which compares with the 66.2% delinquent by area.

There are 225 miles of roads on the area, including state aid roads, county aid roads and county and township roads.

The average maintenance cost of these roads is about $38.00 a mile, with cost of maintenance for the 31 miles of state aid road being $110.00 per mile; of 56 miles of county aid $75.00 per mile; and of the 138 miles of poorly kept up township and county roads $5.00 per mile. These costs include grading, snow plowing, dragging, snow fence, and miscellaneous maintenance costs for the better roads.

The school situation may be summarized as follows: The per pupil cost is figured at $58.00 which includes all costs for the 171 pupils getting their entire education at schools within the area and costs of transporting the 174 pupils who receive their education outside the area to the township line of the township in which they live. Thus the costs would be higher if all costs were figured for all pupils living within the boundaries of the tract.

The number of school bus miles - 392 - is very high, and points out the need of consolidating isolated settlers.

The entire economic situation shows the need of:

1. Taking the submarginal lands out of the hands of land speculators and placing it in productivity as forest land.

2. Reducing costs of schools, roads, and government by consolidating settlers in more compact settlement and removing the isolated ones.

3. Taxing lands of lesser productivity in a more equitable manner.

Of this amount, $29,106.75 was actually collected, or 40%, leaving 30% delinquent by amount which compares with the 60.5% delinquent by area.

There are 375 miles of roads on the area, including state aid roads, county aid roads and county and township roads.

The average maintenance cost of these roads is about $26.00 a mile, with cost of maintenance for the 31 miles of state aid road being $110.00 per mile; of 88 miles of county aid $73.00 per mile; and of the 186 miles of poorly kept up township and county roads $8.00 per mile. These costs include grading, snow plowing, dressing, snow fence, and miscellaneous maintenance costs for the better roads.

The school situation may be summarized as follows: The per pupil cost is figured at $12.00 which includes all costs for the 171 pupils cutting their entire education at schools within the area and costs of transporting the 174 pupils who receive their education outside the area to the township line of the township in which they live. Thus the costs would be higher if all costs were figured for all pupils living within the boundaries of the tract.

The number of school bus miles - 288 - is very high, and points out the need of consolidating isolated settlers.

The entire economic situation shows the need of:

1. Taking the submarginal lands out of the hands of land speculators and placing it in productivity as forest land.

2. Reducing costs of schools, roads, and government by consolidating settlers in more compact settlement and removing the isolated ones.

3. Taking lands of lesser productivity in a more equitable manner.

TABLE I

TAXABLE LANDS TAX DELINQUENT BY PERIODS*

Twps.	Total Land Area	Land Tax Delinq. Prior to 1920	Period from 1920 to 1928	Period from 1928 to Present	State Land	Total Percent Delinq.
137-31	22,860.05		9,741.73	4,421.04	40.00	62%
137-32	22,884.28		7,216.34	6,117.13	1,880.00	63%
138-31	22,629.97		11,929.58	4,883.02	920.00	77%
138-32	22,817.75		5,732.66	7,807.90	280.67	60%
139-31	21,521.95		10,867.33	5,506.56	749.85	81%
140-31	17,236.94		9,193.19	2,401.95	1,273.12	73%
141-31	20,577.19	280.00	7,605.51	5,922.59	40.00	67%
Total	150,328.13	280.00	62,286.34	37,060.19	5,183.64#	
Percent		.2%	41%	25%	3%	66.2%

45,797.96 acres are tax paid which equals 33.8% of the taxable Area

(*) Period during which delinquency first occurred.
(#) Most of these are state lands sold on "Certificate of Sale"and the contract not having been fulfilled,have reverted to the state.

TABLE II

BONDED INDEBTEDNESS

Twps.	Township	County	School	Total
137-31		$15,226.74	$ 271.68	$15,498.42
137-32	$296.47	14,338.27	762.79	15,397.53
138-31	5,507.08	13,757.12	4,789.50	24,053.70
138-32	6,000.00	15,581.27	6,612.06	28,193.33
139-31	4,838.21	12,827.45	1,453.39	19,119.05
140-31	1,177.66	13,088.41	5,554.56	19,820.63
141-31	5,597.12	10,906.29	6,433.91	22,937.32
Total	23,413.54	95,725.55	25,877.89	145,019.98

As of December 31,1930
Latest complete records available

TABLE I

TABLE LAND USE BY REGISTRY OF DEEDS*

Year	Total Land Area	Land Use Taking, Prior to 1960	Prior to 1960 As Prior to 1960	Prior to 1960 Due to Change	State Land	Total Property Taking
1957-58	20,000,00		9,741.73	10,258.27	50.00	300
1957-59	20,444.00		7,215.34	8,147.17	1,840.00	100
1958-61	20,020.87		11,270.02	4,083.00	800.00	478
1958-62	20,817.78		8,292.05	7,027.80	380.27	208
1959-63	21,202.35		10,087.55	8,208.88	792.14	215
1960-64	17,206.34		8,100.19	3,400.80	1,275.16	197
1960-65	20,277.17	280.00	1,263.11	8,209.85	80.00	245
Total	120,322.21	280.00	56,270.38	37,030.19	6,168.57	
Percent		2%	47%	30%	5%	

In 1957-58 active and the paid value equals 52.0% of the taxable area

In 1957-58 active and the paid value equals 52.0% of the taxable area

(*) Typical Suffolk County registry (Lots) locations.
(#) Just of these are state lands and is therefore of doubtful the contract not having been fulfilled,are included in the state

TABLE II

SOUTHERN LIGHTHOUSE

Year	Property	Total	Prior to 1960	Prior to 1960 As Prior to 1960	Prior to 1960 Due to Change
1957-58		910,320.47		47,320.47	
1957-59	6,000.47	16,320.47	700.47	15,620.47	
1958-61	[illegible]	23,727.32	4,788.80	18,938.52	
1958-62	6,000.00	30,181.27	1,612.00	28,569.27	
1959-63	4,858.21	32,027.48	1,414.32	30,613.16	
1960-64	1,177.00	33,000.40	1,000.40	32,000.00	
1960-65	1,000.12	34,000.52	1,400.00	32,600.52	
Total	20,015.31	89,700.00	9,475.39	80,224.61	

As of December 31,1960
Latest complete records available

TABLE III

TAX DATA

Twps.	Assessed Valuation	Total Tax Levy	Total Tax Collected	Percent
137-31	$90,987.00	$ 8,949.38	$ 3,983.77	44%
137-32	85,674.00	12,658.35	3,937.38	31%
138-31	82,205.00	10,886.60	2,977.14	27%
138-32	93,101.00	14,276.89	7,076.71	50%
139-31	76,648.00	8,597.11	2,315.77	27%
140-31	78,210.00	8,783.75	3,784.92	43%
141-31	65,168.00	9,423.52	5,033.10	53%
Total	$571,993.00	$73,575.60	$29,108.79	40%

As of Dec. 31,1930 - latest complete records available.

Recommendations and Conclusions

It is recommended that the 150,328 acres of land within the boundaries of Townships 137 Range 31 and 32, Township 138 Range 31 and 32, Township 139 Range 31, Township 140 Range 31, Township 141 Range 31, except that portion of Township 141 Range 31 east of the present location of State Trunk Highway No. 19 be set aside as the Foothills State Forest and Conservation Area. That all lands within these boundaries now owned by the state and all lands which are acquired by the state through the reverting of tax delinquent land or otherwise shall be set aside and managed on forestry principles for production of timber, and for recreation, game production and allied purposes, or if agricultural, used for that purpose.

To have this area so set aside and managed would result in many immediate as well as future benefits for everyone concerned. It would put the area into full productivity and keep it so. It would provide increased recreational facilities as hunting, fishing, public camp and picnic grounds and summer homes for many who do not now have these opportunities. It would aid in preserving and increasing many of the natural beauties of the area. It would result in a reduction of expenditures for the minor governing bodies thru zoning of the settlers by allowing them to settle only on the best lands in compact settlement. Having the hills and watersheds

TABLE III

TAX DATA

Type.	Assessed Valuation	Total Tax Levy	Total Tax Collected	Percent
137-31	$90,[illegible].00	$ 2,[illegible]	$ 2,[illegible].77	41%
137-32	88,674.00	12,[illegible].35	3,[illegible].36	31%
138-31	92,[illegible].00	10,[illegible].80	2,[illegible].14	27%
138-32	83,101.00	14,[illegible].98	7,[illegible].71	50%
139-31	75,[illegible].00	8,[illegible].11	2,[illegible].77	27%
140-31	70,210.00	8,[illegible].78	3,[illegible].92	43%
141-31	[illegible].00	2,[illegible].22	[illegible].10	[illegible]
Total	$571,[illegible].00	$[illegible].00	$[illegible].77	[illegible]

As of Dec. 31,1930 - latest complete records available.

Recommendations and Conclusions

It is recommended that the 100,000 acres of land within the boundaries of Townships 137 Range 31 and 32, Township 138 Range 31 and 32, Township 139 Range 31, Township 140 Range 31, Township 141 Range 31, except that portion of Township 141 Range 31 east of the present location of State Trunk Highway No. 18 be set aside as the Foothills State Forest and Conservation Area. That all lands within these boundaries now owned by the state and all lands which are acquired by the state through the reverting of tax delinquent land or otherwise shall be set aside and managed as forestry principles for production of timber, and for recreation, game production and allied purposes, or if agricultural, used for that purpose.

To have this area be set aside and managed would result in many immediate as well as future benefits for everyone concerned. It would put the area into full productivity and keep it so. It would provide increased recreational facilities as hunting, fishing, public camp and picnic grounds and summer homes for many who do not have these opportunities. It would aid in preserving and increasing many of the natural beauties of the area. It would result in a reduction of expenditures for the minor governing bodies from owning of the settlers by allowing them to settle away on the best lands in compact settlement. Having the hills and watersheds

covered would result in maintaining and restoring lake levels and controlling surface runoff and erosion. It would stabilize conditions of employment and aid the settler in augmenting his income by woods or recreational work. It would aid in stabilizing timber production and provide a sustained source of raw material for local wood-using industries.

In brief it would aid in the solution of the great land utilization problem which faces the state in its northern counties.

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